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Archie, Jr. et al.

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(45) **Date of Patent: Mar. 1, 2005**

(54) **APPARATUS FOR MAKING A TWO-SIDED IMAGE**

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(21) Appl. No.: **10/353,664**

(22) Filed: **Jan. 29, 2003**

(65) **Prior Publication Data**

US 2003/0111183 A1 Jun. 19, 2003

Related U.S. Application Data

(62) Division of application No. 09/685,397, filed on Oct. 10, 2000, now Pat. No. 6,562,171, and a division of application No. 09/686,133, filed on Oct. 10, 2000, now Pat. No. 6,746,051.

(51) **Int. Cl.**[7] **B32F 1/10**

(52) **U.S. Cl.** **156/463**; 156/461; 493/399; 493/439; 493/443

(58) **Field of Search** 156/204, 226, 156/227, 461, 463; 493/396–403, 439, 443, 446

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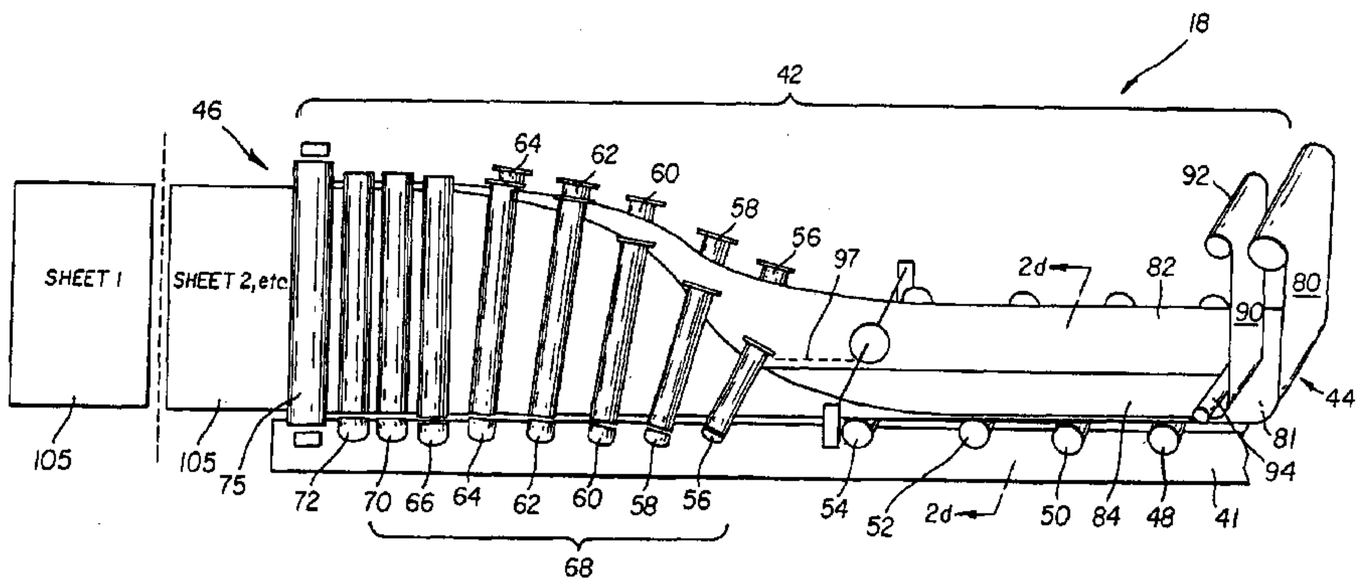
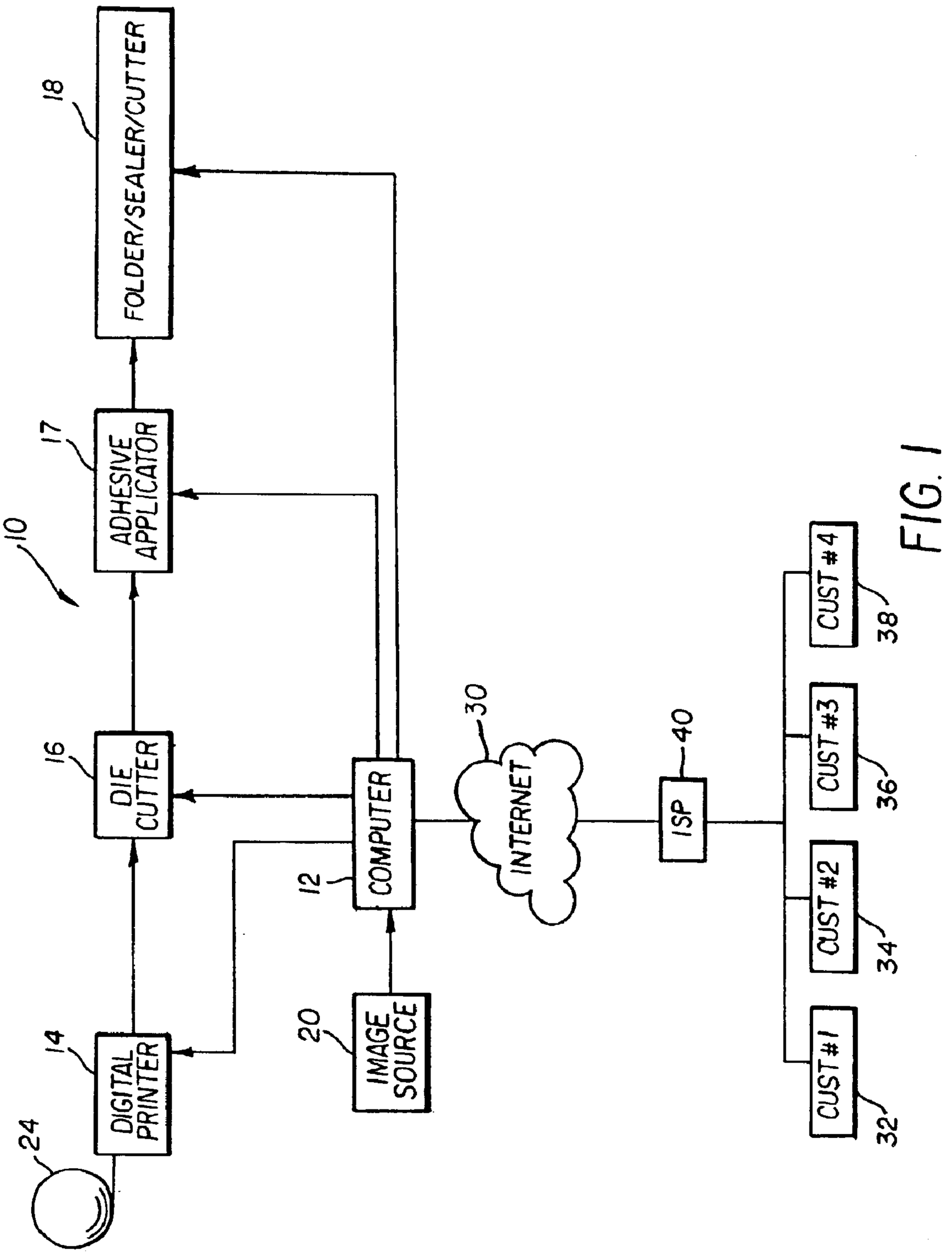
(74) *Attorney, Agent, or Firm*—Frank Pincelli

(57) **ABSTRACT**

A method and apparatus for the manufacture of a two-sided image product is disclosed, comprising the steps of: providing a web of media having an image bearing side and a non-image bearing side; printing a plurality of undetermined images on the image bearing side; applying an adhesive to the non image bearing side; moving the web of media in a direction longitudinal to the web; forming a crease line on the web of media, the crease line running in the longitudinal direction along the web; and folding the web of media along the crease line so that the non-image bearing side contacts itself so as to adhere the non-image bearing side to itself.

12 Claims, 13 Drawing Sheets

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18
ADHESIVE APPLICATOR
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DIE CUTTER
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COMPUTER
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INTERNET
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ISP
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CUST #4
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CUST #3
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CUST #2
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CUST #1
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DIGITAL PRINTER
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IMAGE SOURCE
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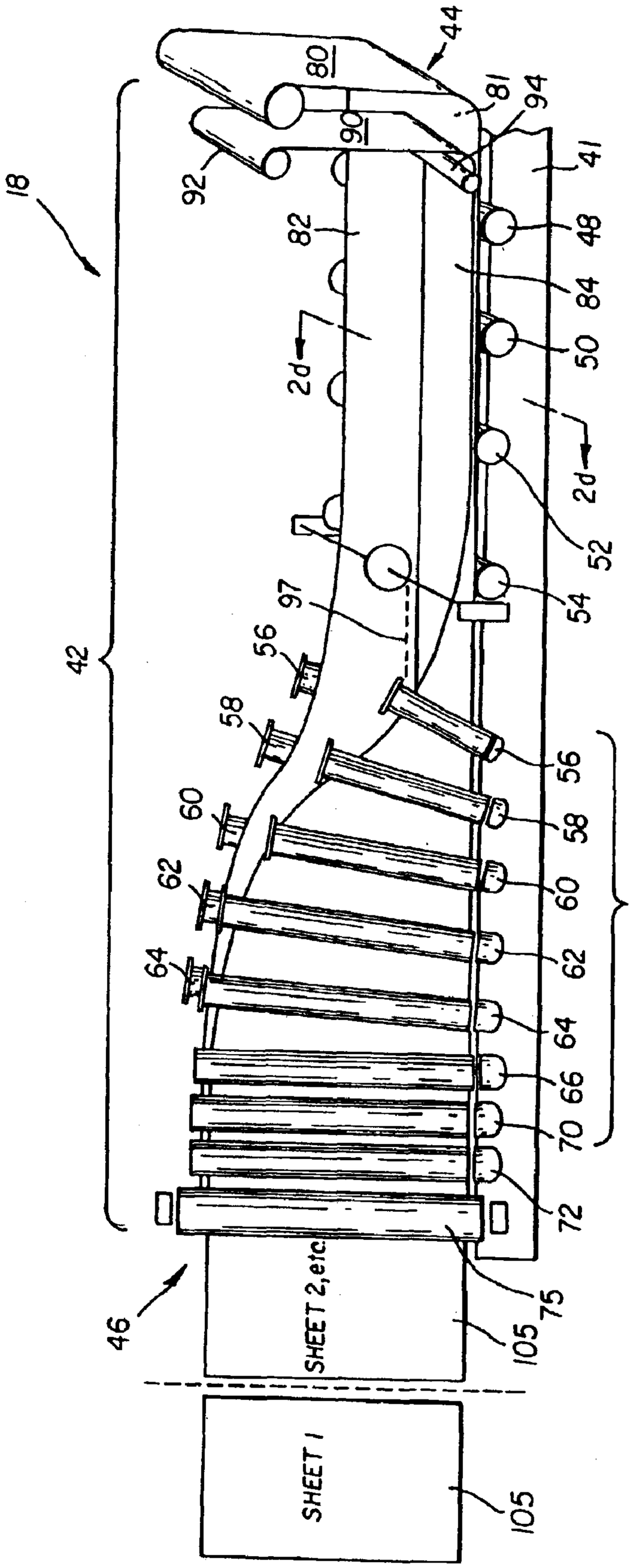
FIG. 1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SHEET 2, etc
SHEET 1

FIG. 2a


80
84

FIG. 2d

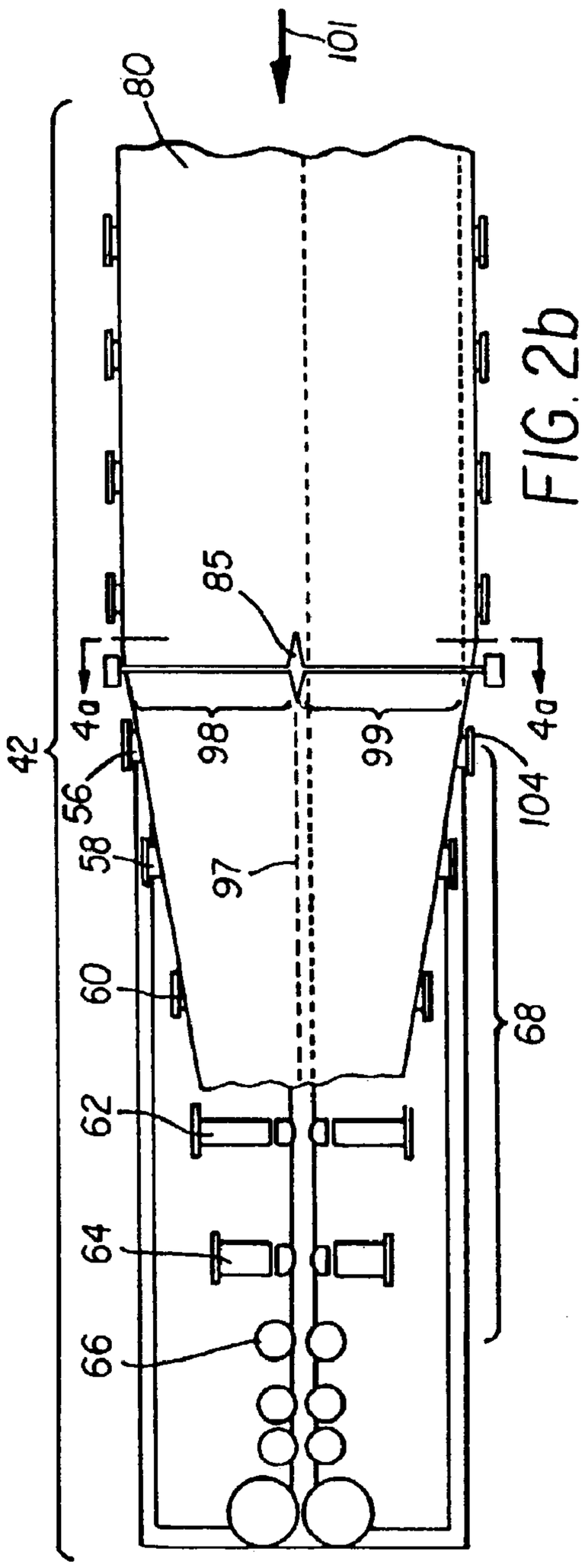
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FIG. 2b

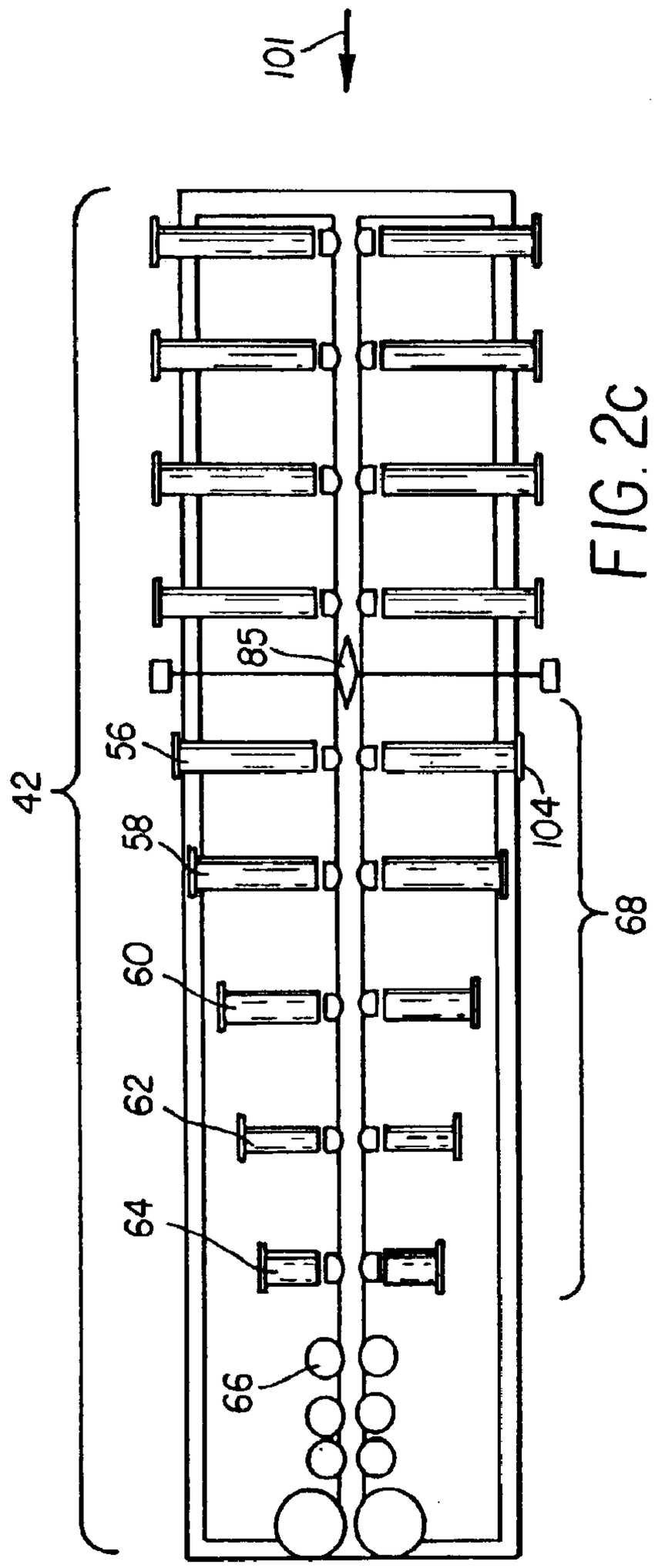
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FIG. 2c

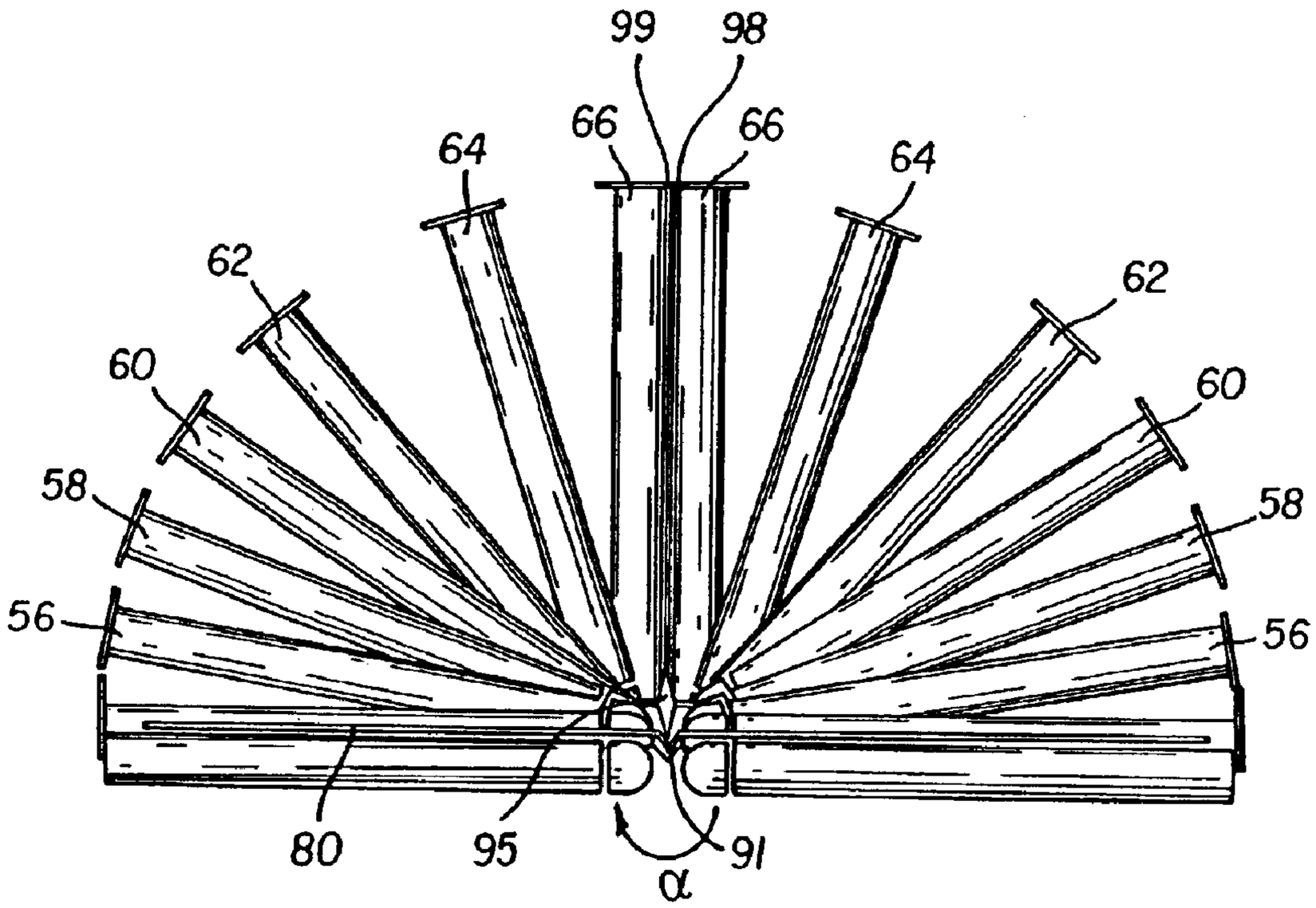

FIG. 3

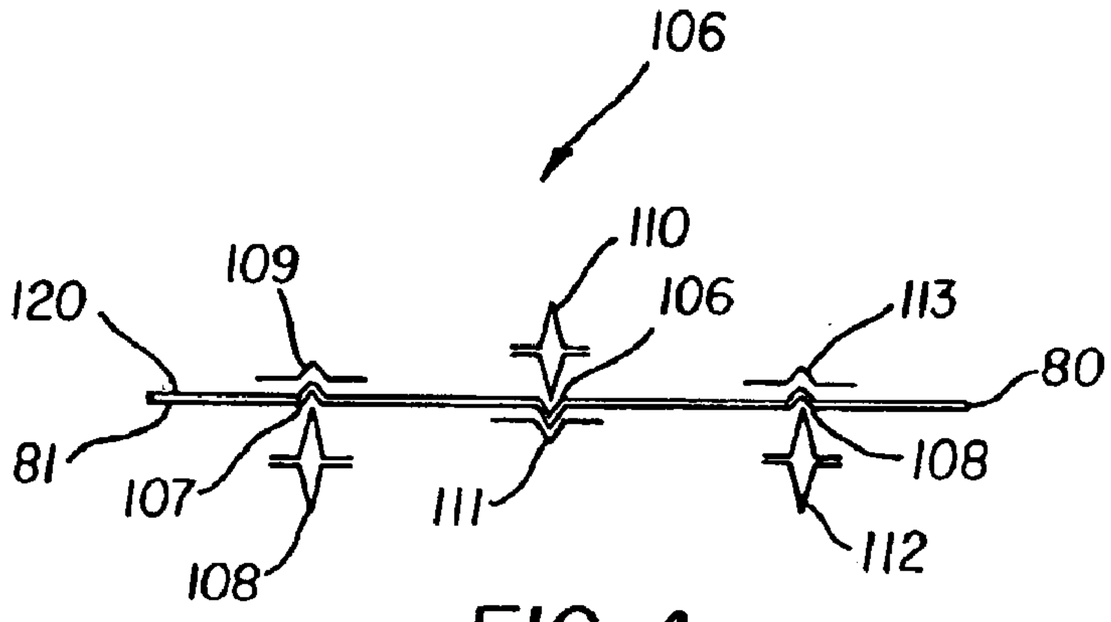

FIG. 4a

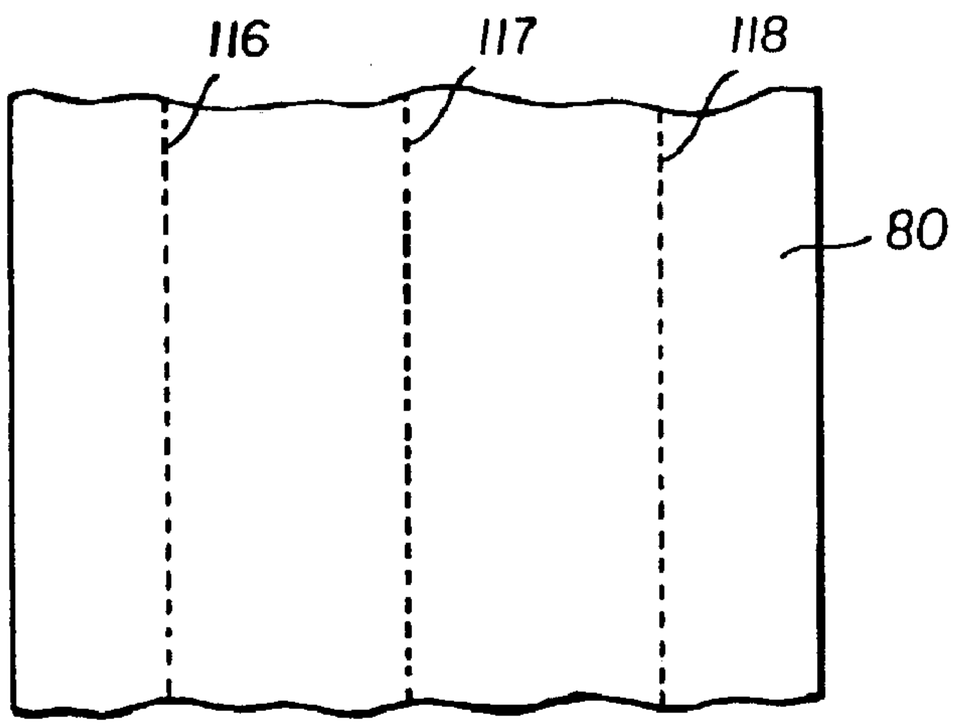

FIG. 4b

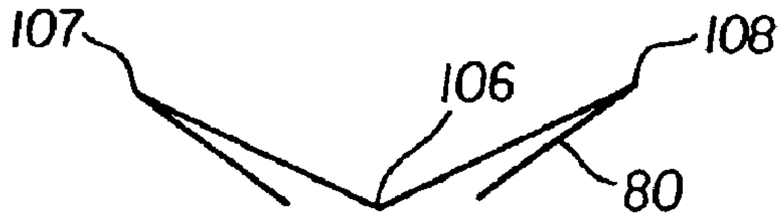

FIG. 4c

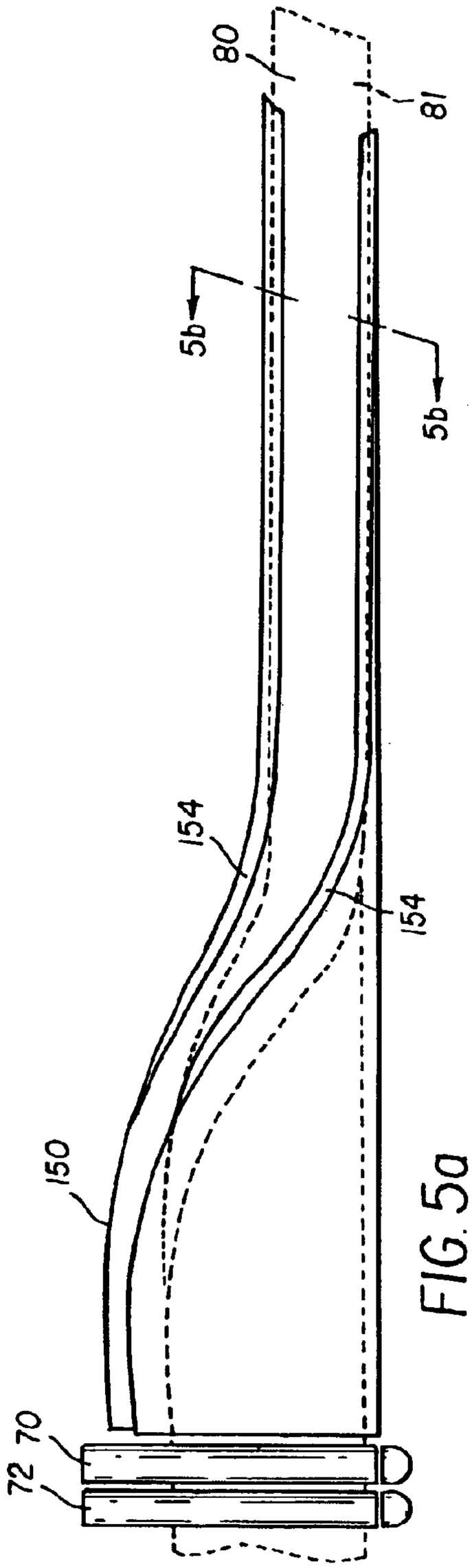

FIG. 5a

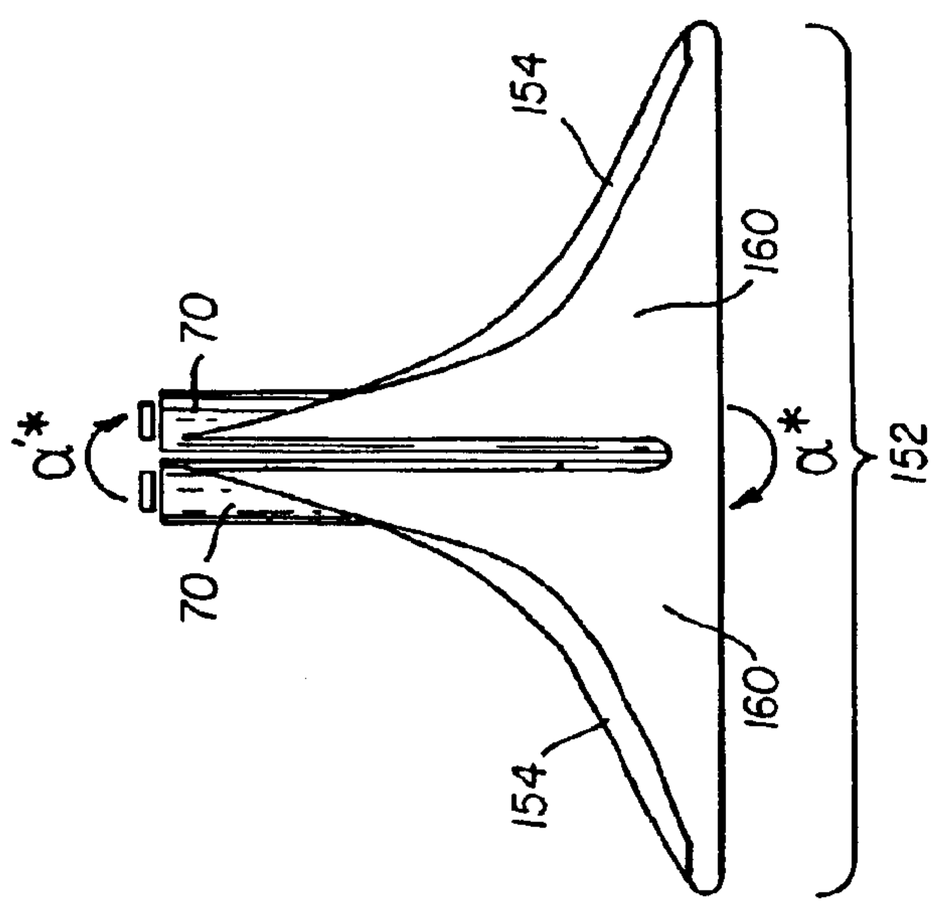

FIG. 5b

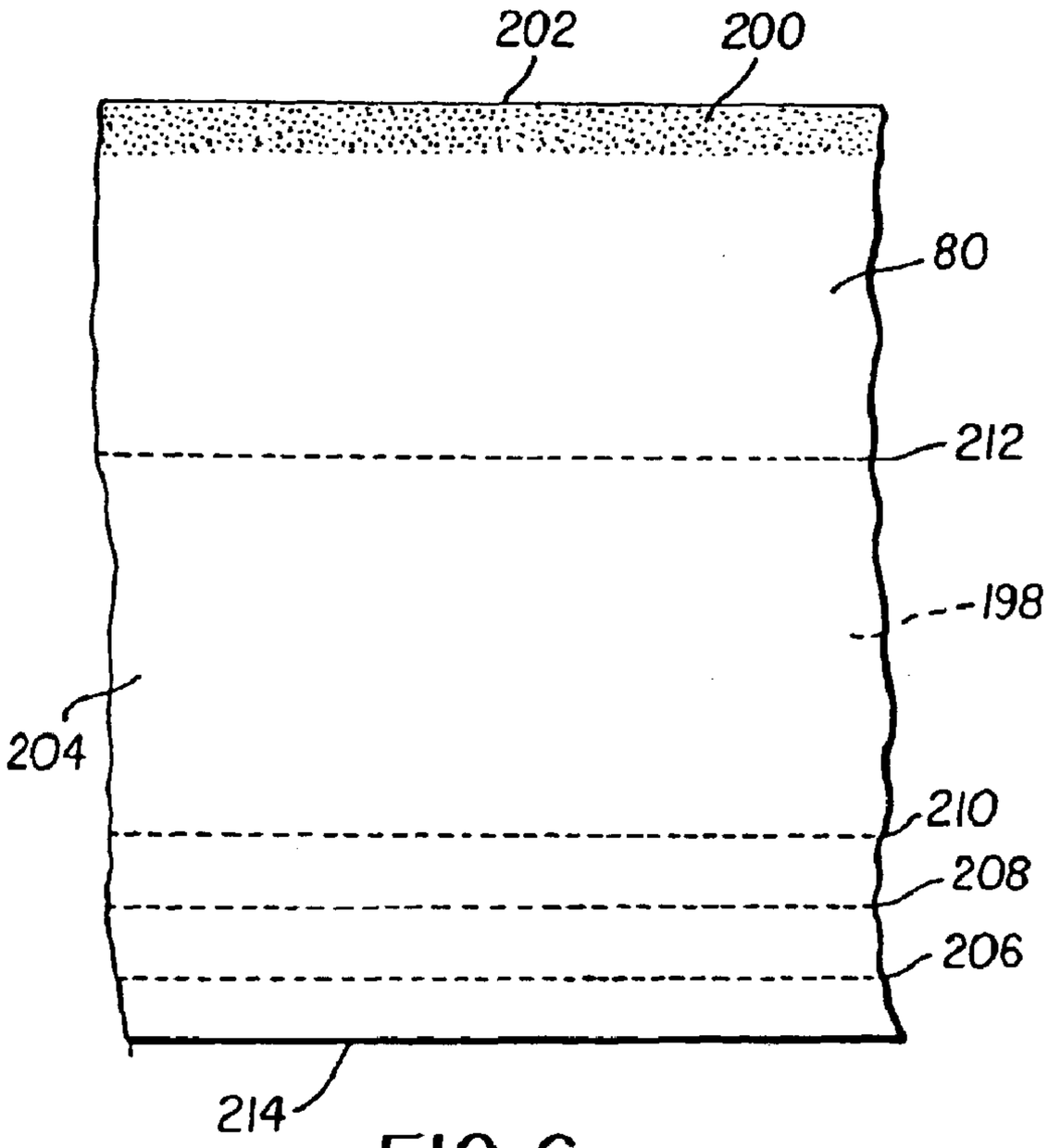

FIG. 6a

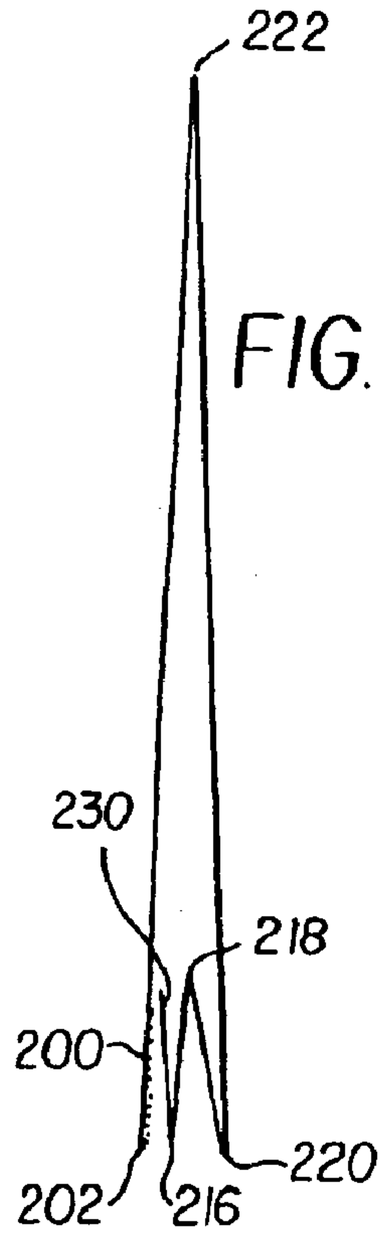

FIG. 6b

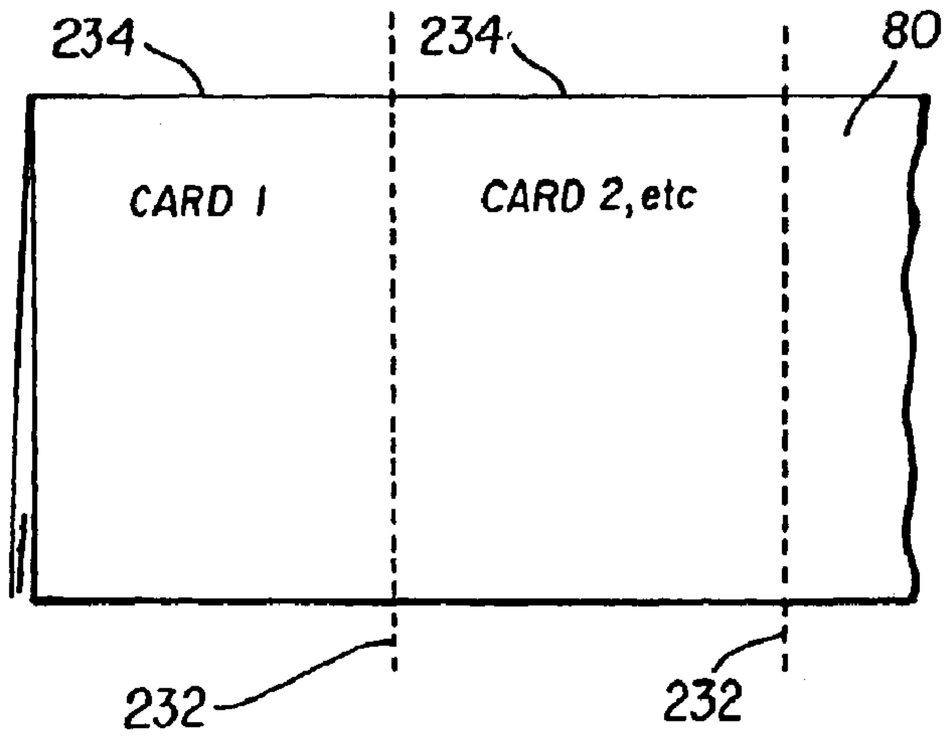

FIG. 6c

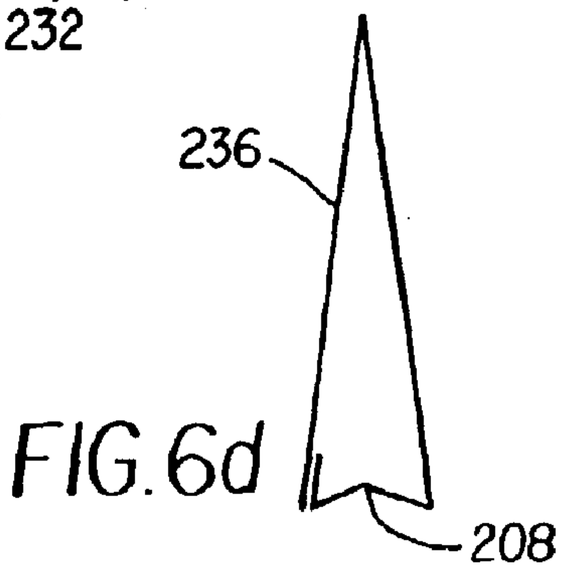

FIG. 6d

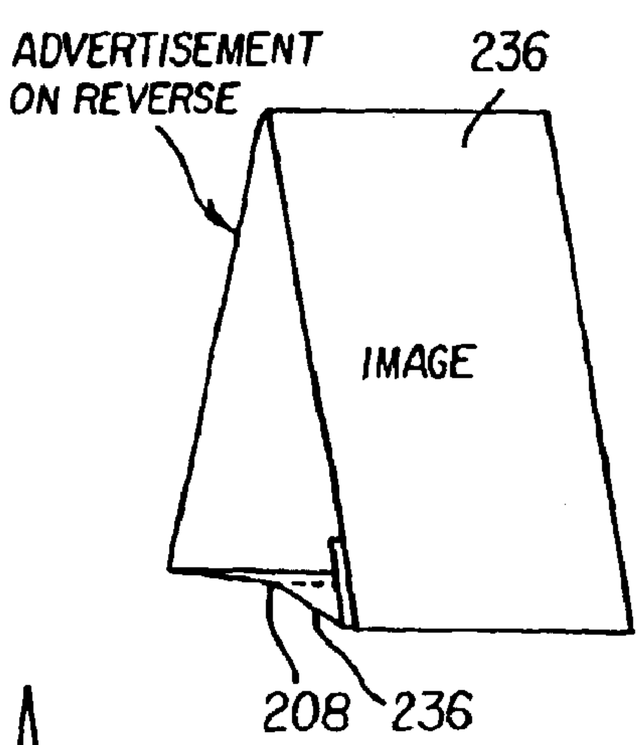

FIG. 6e

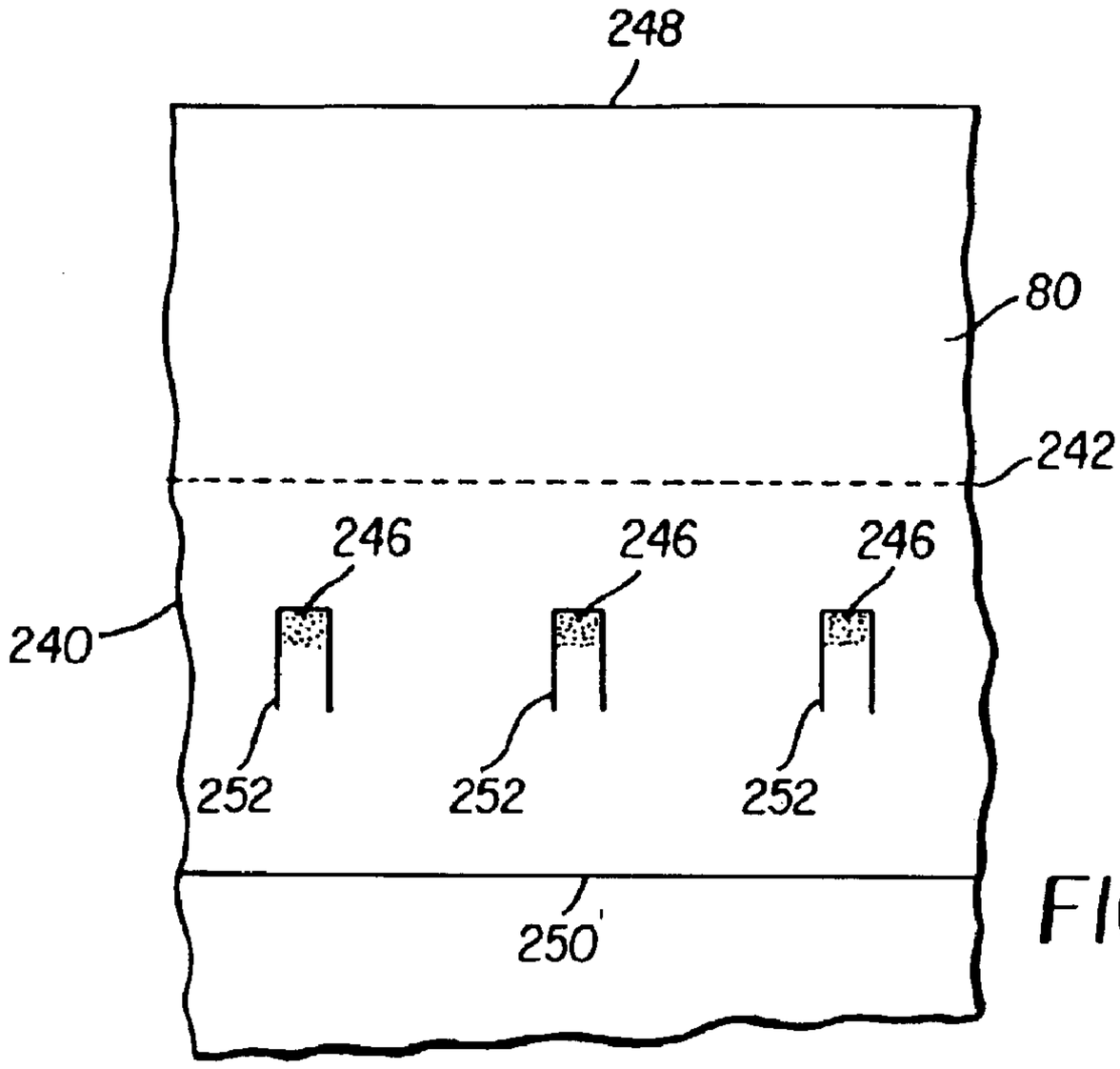

FIG. 7a

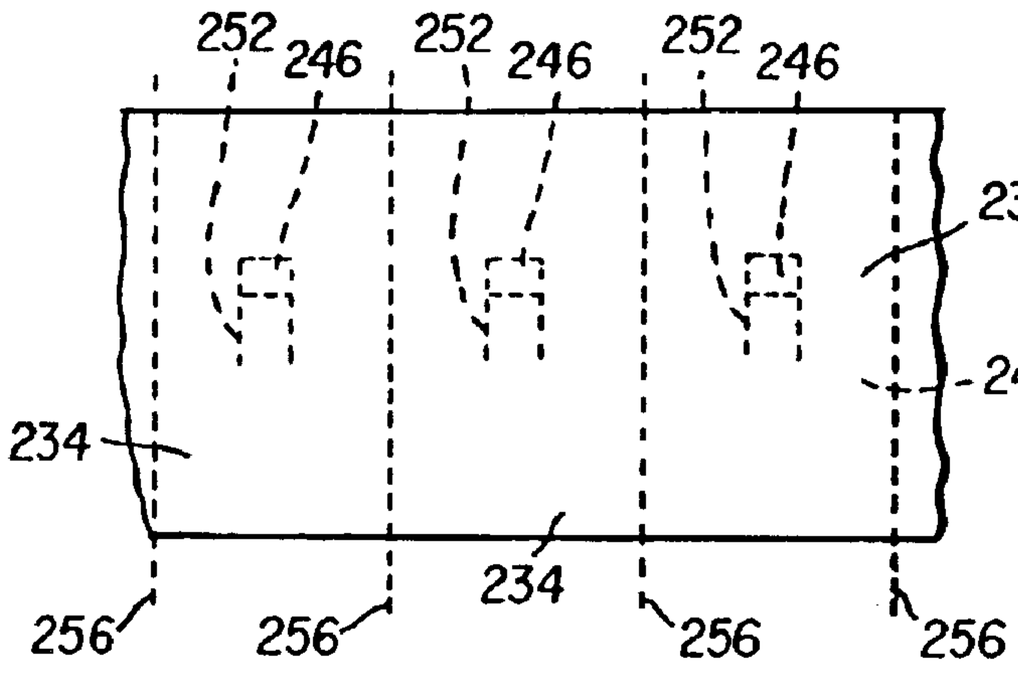

FIG. 7b

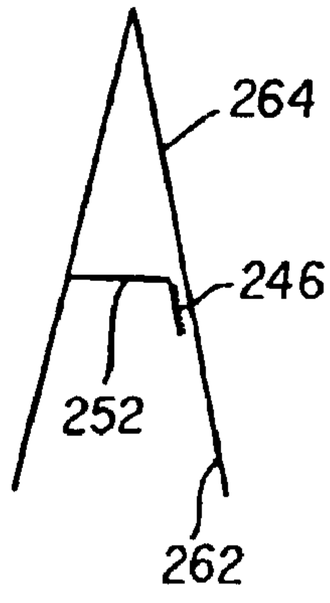

FIG. 7c

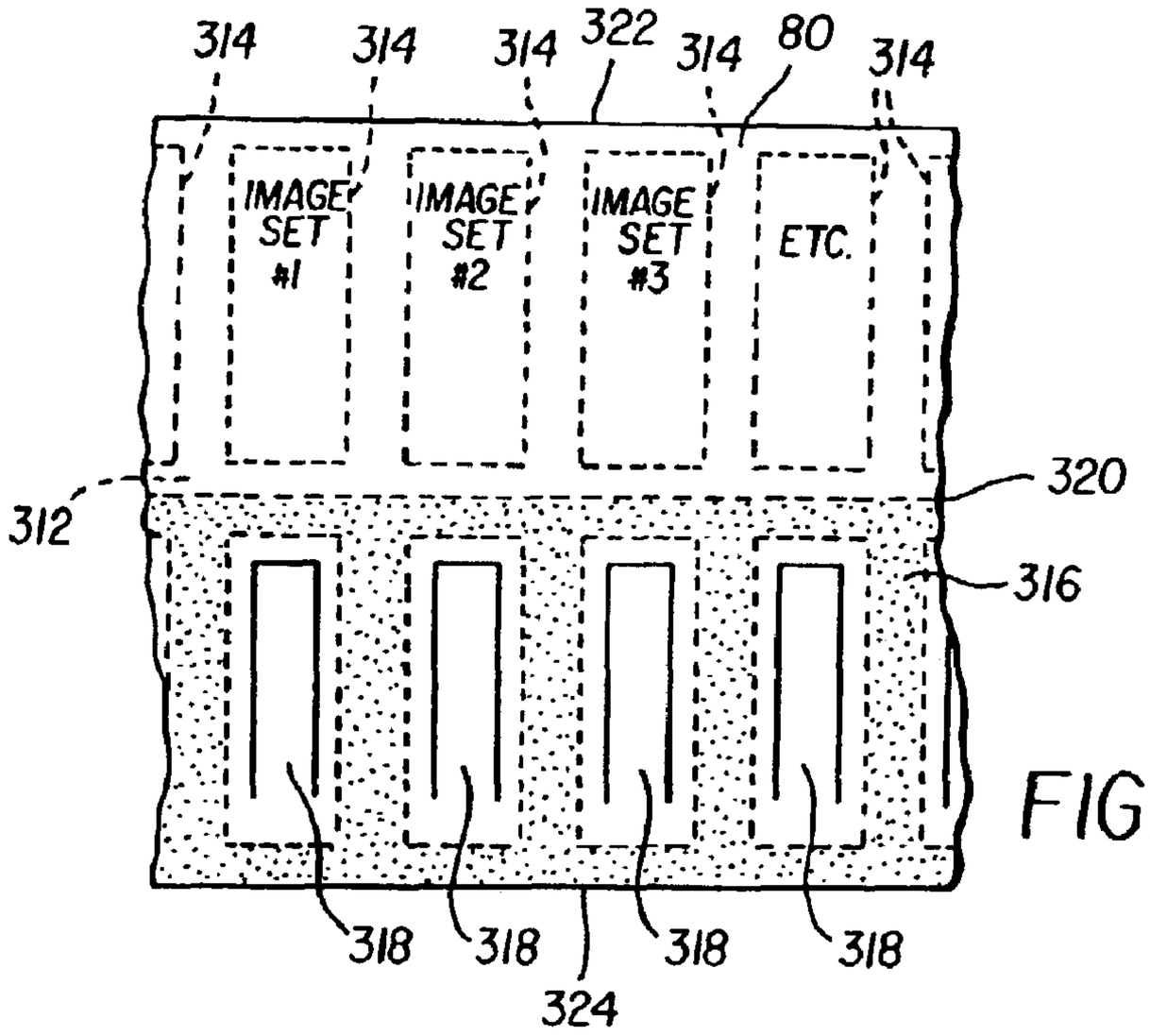

FIG. 8a

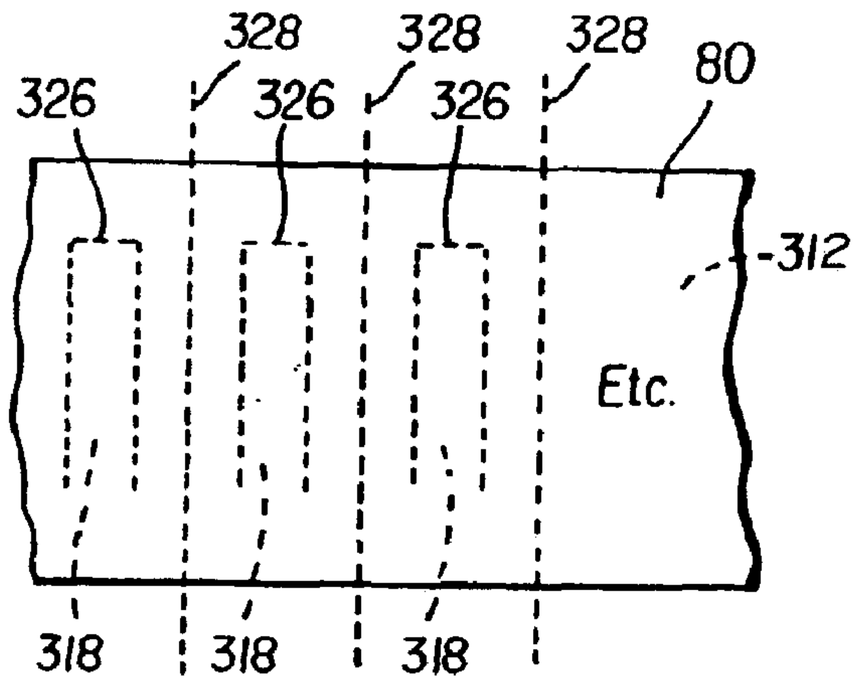

FIG. 8b

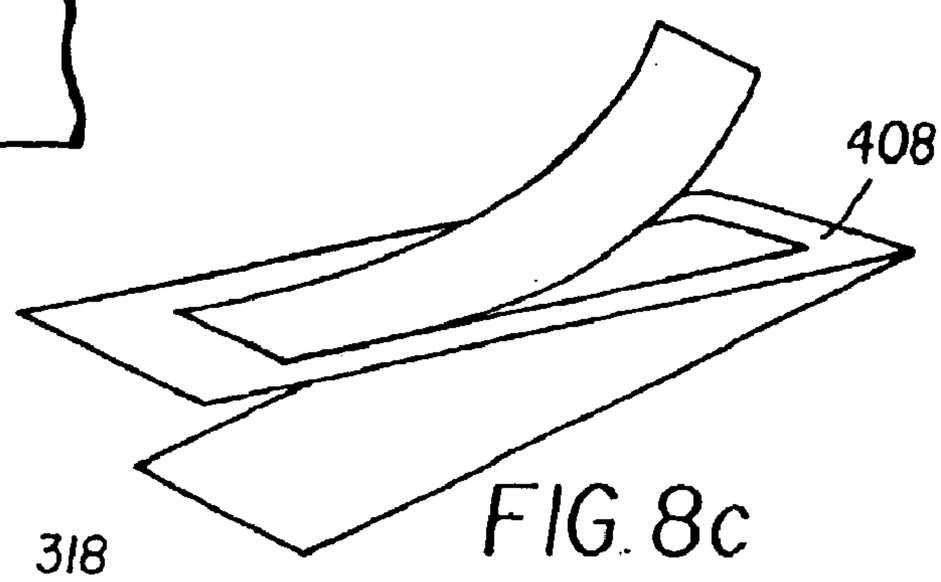

FIG. 8c

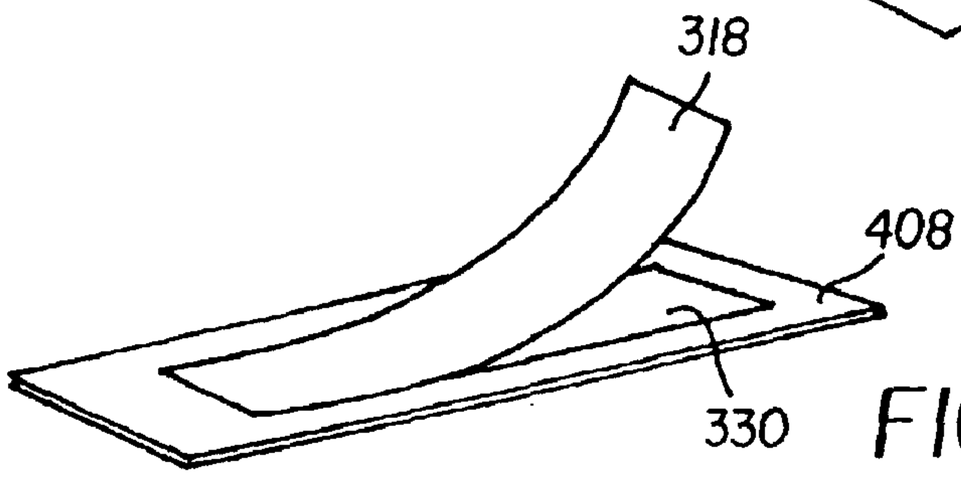

FIG. 8d

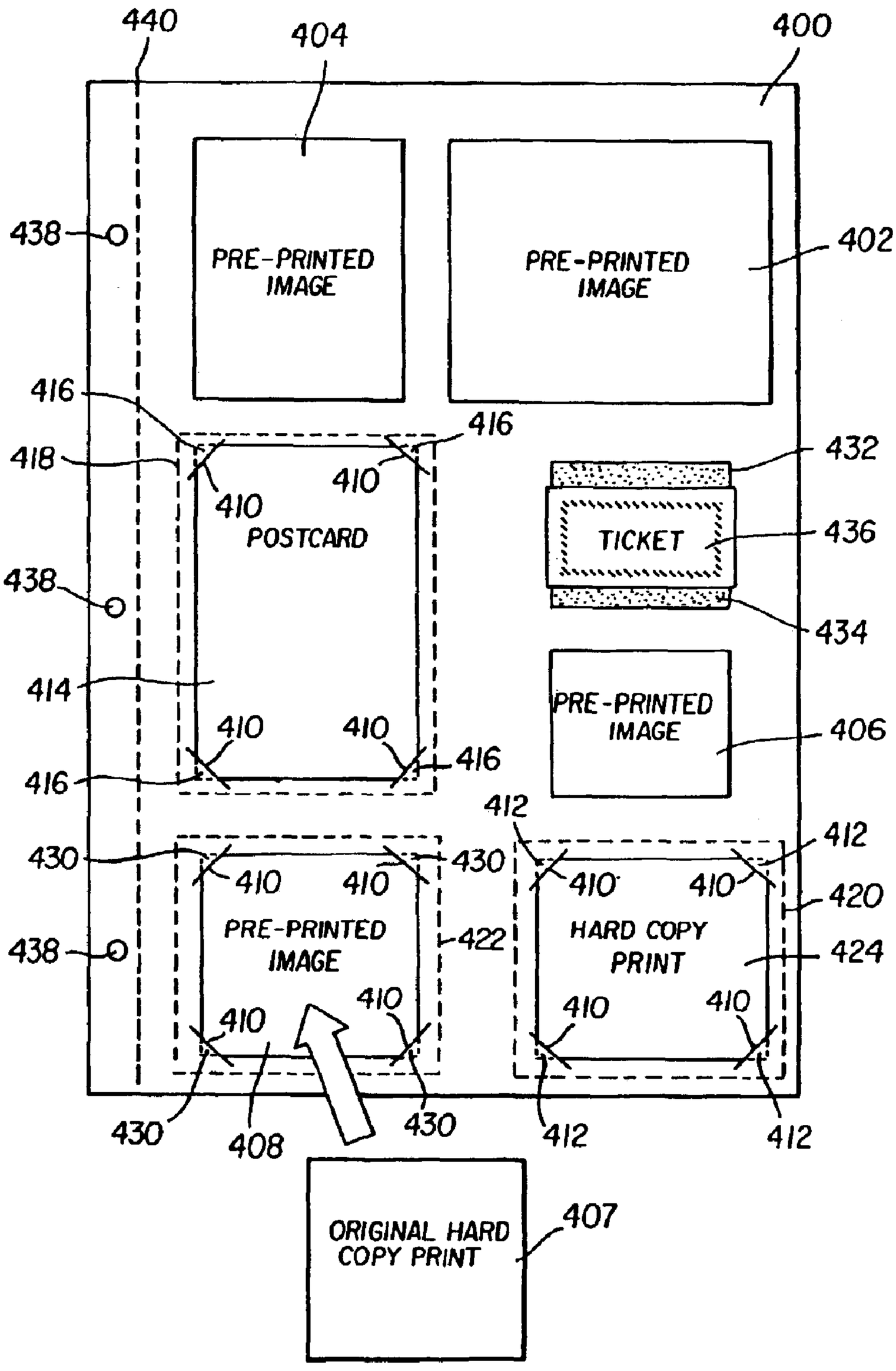
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FIG. 9

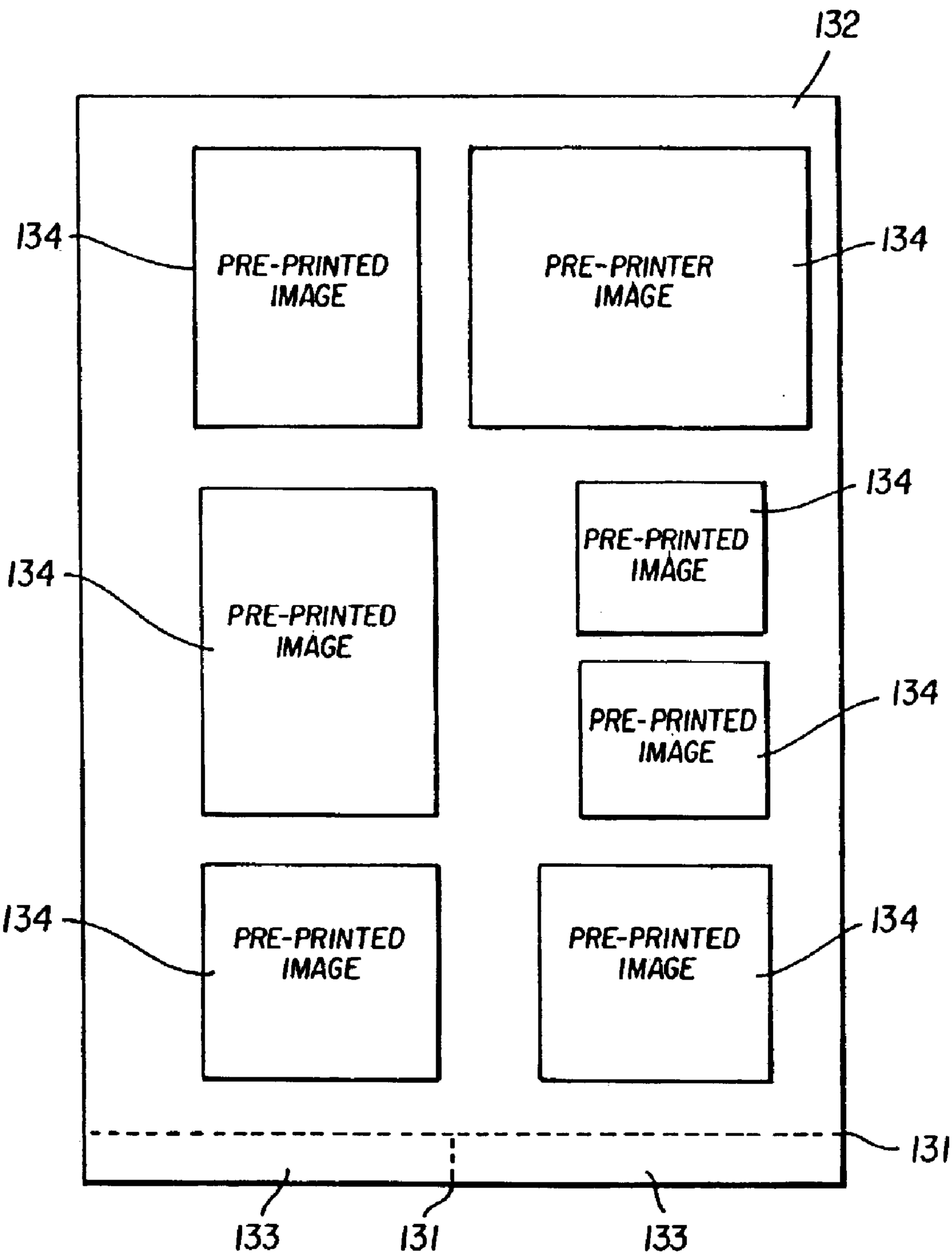
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FIG. 10

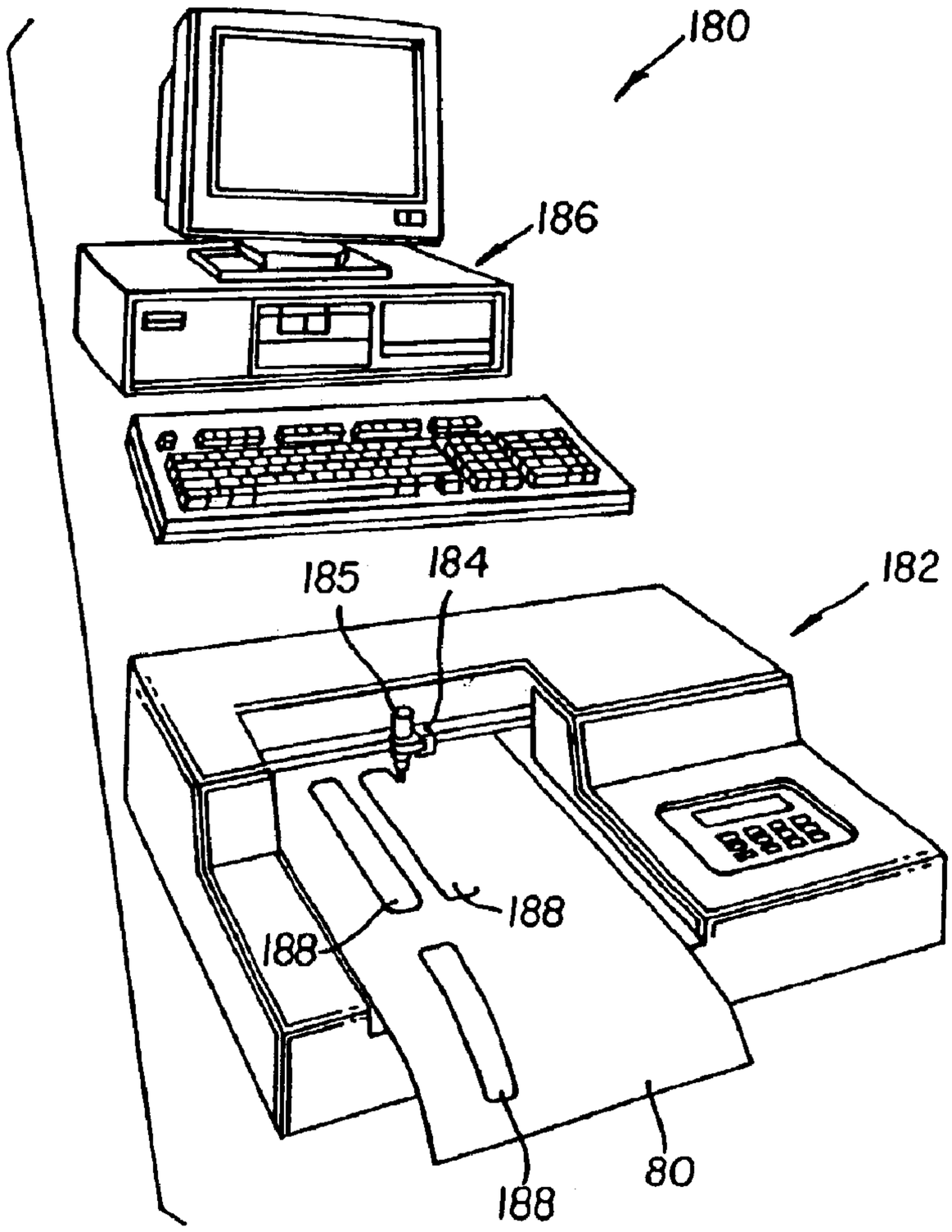


FIG. 11

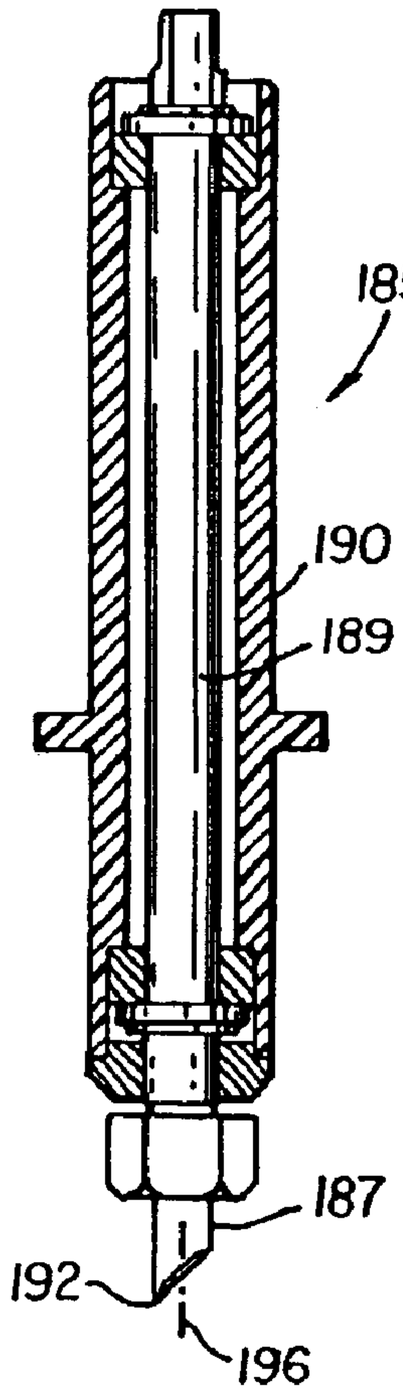
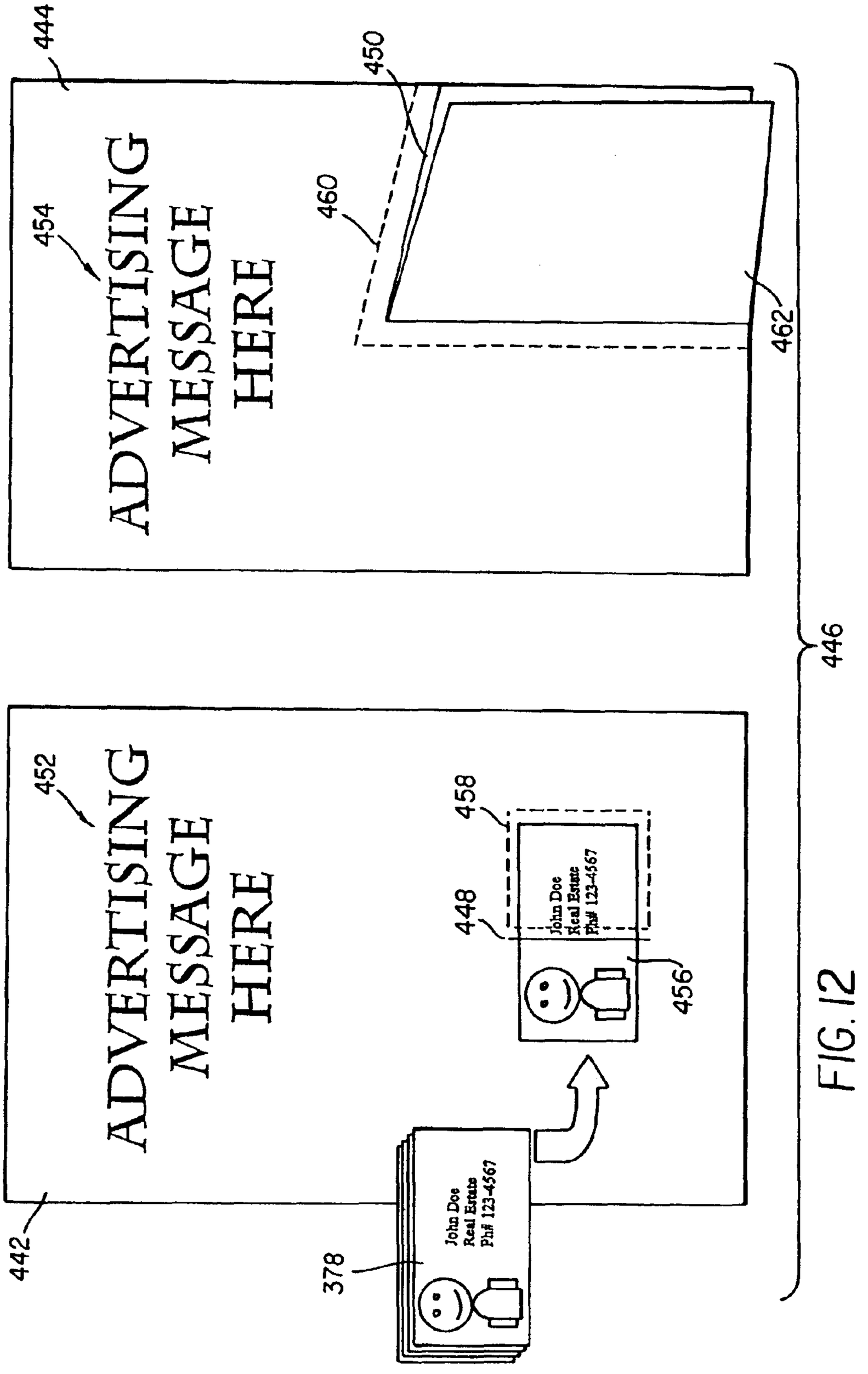


FIG. 11a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John Doe
Real Estate
Ph# 123-4567
456
446
442
378
John Doe
Real Estate
Ph# 123-4567

FIG. 12

APPARATUS FOR MAKING A TWO-SIDED IMAGE

CROSS REFERENCE TO RELATED APPLICATIONS

This is a divisional of application Ser. No. 09/685,397, filed Oct. 10, 2000, now U.S. Pat. No. 6,562,171.

U.S. Ser. No. 09/686,133, filed Oct. 10, 2000, now U.S. Pat. No. 6,746,051, entitled "A TWO SIDED IMAGE PRODUCT" to William C. Archie et al.,

FIELD OF THE INVENTION

This invention is in the field of apparatus and methods of manufacture of image products and, more particularly, in the field of apparatus and methods for continuous manufacture of two-sided image products.

BACKGROUND OF THE INVENTION

Until recently the majority of photographic images were supplied to consumers in the form of the familiar silver halide-based photographic print consisting almost always of just one image printed on one side of a paper or paper-like medium. While the venerable photographic print has served the marketplace well for over a hundred years, the advent of new digital printing technologies utilizing silver halide media and other newer print media has enabled the printing of a much greater variety of photographic image bearing products. For example, the capability now exists to easily compose and print multiple images on a single sheet. One recent example which capitalizes upon these capabilities to generate novel image products is disclosed in the series of U.S. Pat. Nos. 5,791,692; 5,957,502, 6,004,061, 6,435,562, and 6,173,992. This series of patents discloses various aspects of dual sided photoalbum sheets and methods of making them by folding image bearing print media over on itself and adhering the folded sheet together to create an attractive two-sided page with desirable properties. The methods disclosed by Manico, while very useful, do not lend themselves to the manufacture of two-sided image bearing sheets in a continuous manner. Such a continuous method would lend itself much better to high volume, low-cost manufacturing of not only two-sided album pages, but also a variety of other two-sided image-bearing products.

SUMMARY OF THE INVENTION

In accordance with one aspect of the present invention there is provided an apparatus for manufacture of a two-sided image product, comprising transport means for moving a web of media in a direction longitudinal to the web, the web having an image bearing side and a non-image bearing side with a plurality of undetermined images printed on the image bearing side, and the non-image bearing side having an adhesive thereon; means for applying adhesive to the non-image bearing side of the web of media; a creasing device for forming a crease line on the web of media, the crease running in the longitudinal direction along the web; and a folding device for folding the web of media along the crease so that the non-image bearing side contacts itself so as to adhere the non-image bearing side to itself.

In accordance with another aspect of the present invention there is provided a system for making customized two sided image products for a plurality of customers, comprising:

a computer for coordinating a plurality of customer orders for custom image products having image content;

a digital printer for printing the image content of the customer orders on an image bearing side of a web of media, the web having a non-image bearing side;

an adhesive applying mechanism for applying an adhesive on the non-image bearing side of the web;

a folding mechanism for folding the web such that the non-image bearing side contacts itself;

a cutting mechanism for cutting the folded web for separating the custom image products from the web.

These and other aspects, objects, features and advantages of the present invention will be more clearly understood and appreciated from a review of the following detailed description of the preferred embodiments and appended claims, and by reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the detailed description of the preferred embodiments of the invention presented below, reference is made to the accompanying drawings in which:

FIG. **1** shows a schematic block diagram of a continuous manufacturing system for two-sided image products made in accordance with the present invention;

FIG. **2***a* is an illustration showing a perspective view of an apparatus in accordance with the present invention;

FIG. **2***b* is a top view of the apparatus of FIG. **2***a* with a media being processed;

FIG. **2***c* is a view similar to FIG. **2***b* without the media;

FIG. **2***d* is an enlarged cross sectional end view of a of the apparatus of FIG. **1***a* as taken along line **2***d*—**2***d;*

FIG. **3** is an end view of the apparatus of FIG. **1** as taken along line **2***d*—**2***d;*

FIG. **4***a* is a cross section view of the apparatus of FIG. **2***b* as taken along line **4***a*—**4***a* illustrating a modified creasing mechanism made in accordance with the present invention;

FIG. **4***b* is a top view of a portion of the media web which has been creased by the creasing mechanism of FIG. **4***a;*

FIG. **4***c* is an end view of the portion of FIG. **4***b* which has been folded along crease lines introduced by the mechanism of FIG. **4***a;*

FIG. **5***a* is an elevational view of an alternative folding guide of an apparatus in accordance with the invention;

FIG. **5***b* is a cross sectional view of the folding guide of FIG. **4***a* as taken along line **5***b*—**5***b;*

FIG. **6***a* is a top plan view of a portion of the media web of FIG. **1** having crease lines such that when folded will make a two sided image product made in accordance with the present invention;

FIG. **6***b* is an enlarged cross section view of the web of FIG. **6***a* that has been folded along the crease lines;

FIG. **6***c* is top plan view of the folded web of FIG. **6***b* illustrating separation lines for making individual image products;

FIG. **6***d* is a side view of a separated image product of FIG. **5***c;*

FIG. **6***e* is a perspective view of the image product of FIG. **5***d;*

FIG. **7***a* is a top plan view of an alternate web made using the apparatus of FIG. **1** for making a modified two sided image product made in accordance with the present invention;

FIG. **7***b* is top plan view of a portion the web of FIG. **7***a* after it has been folded illustrating three image products that are to be separated from the web;

FIG. **7***c* is an end view of one of the image products of FIG. **7***b* that has been separated from the web and placed in the in use position;

FIG. **8***a* is a view similar to FIG. **6***a* illustrating a modified web made in accordance with the present invention;

FIG. **8***b* is top plan view of a portion of the web of FIG. **8***a* after it has been folded illustrating image products that are to be separated from the web;

FIG. **8***c* is an end view of one of the image products of FIG. **8***b* that has been separated from the web and placed in the in use position;

FIG. **8***d* is an end view of one of the image products of FIG. **8***b* that has been separated from the web and placed in the in use position;

FIG. **9** illustrates a two-sided image product made in accordance with the present invention;

FIG. **10** shows a plan view of one side of a two-sided album page made in accordance with the present invention;

FIG. **11** is a system diagram for a web cutter made in accordance with the present invention;

FIG. **11***a* is a cross-section of a knife pen useful in the system of FIG. **11**;

FIG. **12** illustrates another two-sided advertising display product made in accordance with the present invention; and

DETAILED DESCRIPTION OF THE INVENTION

The present invention is directed to a continuous manufacturing system in which a continuous web of printed media is passed through folding apparatus where the web is folded, sealed and cut so as to provide a plurality of individual image products for a plurality of different custom orders. The present invention preferably uses the capability of digital printing technology to efficiently create a stream of two-sided image products, each one having a unique set of images on it. FIG. **1** shows a block diagram illustrating the components and operation of such a continuous manufacturing system **10** made in accordance with the present invention. In FIG. **1**, the system **10** includes a computer **12** which is connected to and controls and/or provides information to the other system components. In the embodiment illustrated system **10** includes a digital printer **14**, die cutter **16**, adhesive applicator **17**, a folder/cutter/sealer **18** of the present invention, and image source. In operation, digital image files supplied by image source **20** are composed and laid out appropriately for the particular product being produced by composition software running on computer **12**. The image files and layout instructions are sent to digital printer **14** which prints them continuously on a roll (web) of print media **24** (such as photographic paper which is then processed by an appropriate processor (not shown)), taking into account the relative position of images and any cuts and/or folds which will be introduced in the web for producing image products. After printing and processing, the continuous web of print media **24** is sent to die cutter **16** where any cuts are made in the web **24**, according to instructions received from computer **12**. Next, the continuous web of printed media **24** is transported past adhesive applicator **16** where adhesive is applied in designated areas, also under control of computer **12**. The adhesive applicator **16** may be a separate device or part of the folder cutter **18**. Finally, the web **24** passes through the folder/sealer/cutter **18** of the present invention, resulting in finished two-sided image products such as two-sided photo album pages or other products as described below. The folder/sealer/cutter **18** is in communication and/or control of the computer **12** as are the other system components mentioned. The digital printer may place printed fiducial marks (not shown) on the web, preferably along one edge of the web, or a die cutter may place holes (not shown) along the edge of the web for locating positions where the web is to be cut. Sensors (not shown) in the folder/sealer/cutter **18** of a well known mechanical or optical type sense the presence of the fiducial marks or holes and send signals via the computer therein (or computer **12**) to operate the cutter to cut the folded and sealed web into separate image product pieces at the appropriate points along the web.

As illustrated by FIG. **1**, computer **12** may also be in communication with the internet **30** for receiving product orders from a variety of remote locations **32**, **34**, **36** and **38**. As illustrated the remote locations communicate though a local internet service provider (ISP) **40**. Locations **32**, **34**, **36** and **38** may comprise any source that can communicate product for customer orders, for example, but not by way of limitation, individual customer, retail establishments, other printing or photofinishing service providers. Computer **12** can also keep track of the orders and place any desired order tracking information on the web that can be used for tracking, collating, and returning the image products to the appropriate customer.

FIGS. **2***a*–**2***c* and **3** depict in greater detail an embodiment of a folding, sealing and cutting apparatus **18** made in accordance with the present invention. FIG. **2***a* illustrates an elevational view of the apparatus **18**. The apparatus **18** has frame **41** that defines a processing path **42** having an entrance **44** and exit **46**. The frame **41** supports transport rollers **48**, **50**, **52** and **54**, guide roller pairs **56**, **58**, **60**, **62**, **64** and **66** within folding section **68**, driving rollers **70**, sealing rollers **72**, and cutter **75**. A media web **80** enters the apparatus through entrance **44** from the right in FIG. **2***a* and proceeds through the apparatus **18** from right to left. Web **80** has an image-bearing side **81**, shown facing down in FIGS. **2***a* and **2***c*, having at least one image (not shown) pre-printed on it, and a non-image-bearing side **82**, shown facing up in FIGS. **2***a* and **2***c*. The images may be printed on the image-bearing side **81** by any of a number of printing methods including, preferably digital printing including for example, CRT or laser printing where media web **80** is silver halide media, or ink-jet printing where media web **80** is ink-jet media, or thermal or electrophotographic printing where media web **80** is electrophotographic or thermal media respectively.

An important advantage of using digital printing technology in the present invention is the ability the technology confers to print a continuously changing stream of different images on the image-bearing side of the web **80**. Such a stream of different images is herein referred to as a series of undetermined images, to more clearly distinguish this type of operation from one where a stream of identical images are being printed such as in a conventional high speed press operation for printing publications, brochures, etc. The ability to print such a series of undetermined images lends itself well to the continuous production of personalized two-sided image bearing products such as photo album pages, or other image bearing products where each page of product is unique and bears images unique to a particular customer for the products. Another advantage of using digital printing technology in the present invention is that this technology enables images to be sized and positioned anywhere on the image bearing side of the web. This is important not only in the production of photo album pages where a variety of layouts of images may be desired by the customer, but also for precise positioning of images with respect to where the web will be later be creased and folded to form a variety of other two sided image bearing products, such as those illustrated in the embodiments described later.

Web **80** also has adhesive area **84** applied to its non-image bearing side **84** prior to entering the apparatus. FIG. **2***d* illustrates an enlarged partial cross sectional view of the web **80** as taken along line **2***d*—**2***d* with the adhesive area **84** present. The adhesive area **84** may comprise a sheet (layer) of adhesive, for example such as photographic dry-mount adhesive tacked to the web or a coatable adhesive applied continuously to the desired portion of the web prior to entry into the folding apparatus to enable sealing after folding has taken place. The application of an adhesive to a moving web is well known and could be accomplished by a number of techniques including, for example, a coating station with a roll coater, a blade coater, spray coater, or extrusion hopper, or at a tacking station where an adhesive web is continuously tacked to the web as it passes the station. In the embodiment illustrated, a web **90** of adhesive material is laid atop one side of the web **80**. The web **90** is supplied from a roll **92**. An application roller **94** is used for applying a sufficient force for adhering the web **90** to web **80**. In the embodiment illustrated, the web **90** and the adhesive material is heat activated so that it can easily be handled prior to sealing. Alternatively, a dry heat-activated adhesive may have been applied to the media web **80** at an earlier stage.

As shown in FIG. **2***a*, in the operation of the apparatus **18**, media web **80** is transported through the apparatus by driving rollers **70** that grip the folded web **80** and pulling it through the apparatus **18**. The transport of media webs through machines for folding or cutting or other purposes is well known and means other than the one illustrated may be used. For example, a number of rollers in the machine could be driven pinch rollers which would act to transport the web **80**, or a vacuum drive belt or belts could also be used. Since the reverse face **81** of web **80** typically has images printed on it and is also the side of the web contacting the machine, it is important not to damage the image side **81** of the web and the surfaces contacting the web should be made of materials which would not inflict damage by, for example, scratching or marring it. Rollers covered with a rubber such as neoprene or any soft rubber or polymer or other conformable material would be particularly useful in this application. Other surfaces in the apparatus which contact the web **80** may be advantageously coated with Teflon® or other very smooth material with a low coefficient of friction. If desired, air bearings may be provided (not shown) which would allow the web **80** to be "floated" or "flown" over portions of the machine to minimize damage to the web **80**.

As can be seen by reference to FIGS. **2***a*–**2***c* and **3** folding of the web **80** begins as it passes under creasing roller **85** which presses the web against die **91** thereby creating a crease line **97** and forming two sections **98** and **99** that are to be folded toward each other. Next, as the web **80** moves along processing path **42** in the direction indicated by arrow **101**, it passes into folding section **68** which comprises a series of guide roller pairs **56**, **58**, **60**, **62**, **64** and **66** for bringing sections **98** and **99** together. Referring to FIG. **3**, it may be more clearly seen that the angle α between the roller pairs decrease progressively from 180 degrees to an angle of substantially 0 degrees as the web **80** is drawn through them, thereby folding the web **80** along the crease line **97**. In the embodiment illustrated, each of the roller pairs **56**, **58**, **60**, **62**, **64** and **66** has a guide flange **104** at the end to constrain the web **80** as it is moving along the processing path **42**.

While FIGS. **2***a*–**2***c* and **3** illustrate a folding operation in which the web **80** is folded substantially in two equal sections **98** and **99**, it will be appreciated that apparatus **18** could easily be constructed which would place the longitudinal crease line **97** at a position other than the longitudinal center line of the web **80** and that this would allow the web **80** to be folded in a position other than the center. It will also be appreciated that more than one crease line could be introduced into the web **80** at different positions across the web and that these crease lines could be introduced on either the image-bearing or non-image bearing sides of the web, or both. By way of an illustration of this latter possibility, FIG. **4***a* provides a detailed view of an alternative creasing section which may be used in the apparatus of FIG. **2***a*. The modified creasing mechanism **106** comprises creasing rollers **108**, **110**, and **112** and associated dies **109**, **111** and **113** arranged to introduce three creases lines **116**, **117** and **118** into the web **80**. In FIG. **4***a*, roller **110** and die **111** cooperate to introduce crease line **117** on the non-image bearing side **120** of web **80**, while the combinations of roller **108** with die **109** and roller **112** with die **113** introduce crease lines **116** and **118** respectively into the image-bearing side **81** of web **80**. FIG. **4***b* shows a top view of web **80** as it appears after passing by the creasing mechanism **106** depicted in FIG. **4***a*; the positions of crease lines **116**, **117** and **118** are shown in FIG. **4***b*. The multiple crease lines thus introduced then enable web **80** to be folded at more than one place as shown in FIG. **4***c* which depicts an end view of web **80** folded along crease lines **116**, **117** and **118**.

Returning to FIGS. **2***a*–**2***c*, a pair of sealing rollers **72** are provided for adhering the two sections **98** and **99** together. Rollers **72** apply pressure to cause sections **98** and **99** of the folded web to adhere to each other permanently (see FIG. **3**). For certain types of adhesive, for example, photographic dry-mounting adhesive or other heat-activatable adhesives, it may be desirable to apply heat in addition to pressure during the sealing step. The application of heat and pressure can be supplied by a pair of opposed heated rollers, or heat may be applied to the web by some technique separate from the rollers such as, for example, by contacting the web with a heating bar, by radiant heating by a heating element, by directing heated air at the web, or by the use of microwave energy simultaneous with, or separate from the application of pressure.

Referring to FIGS. **2***a*–**2***c*, once the sections **98** and **99** have been sealed to each other, the folded web is cut using cutter **75** into appropriate size sheets **105** at predetermined locations, for example two-sided album pages FIG. **10** illustrates a plan view of one side of such a two-sided album page **132** with pre-printed images **134**. In addition, perforations **131** may be provided on album page **132** for allowing optional removable segments **133** that can be removed later by the service provider or the customer. Segments may have information that has been printed there that may be used for processing of the image goods, such as a customer order number or a customer mailing label. Any of a number of cutting devices are useful as the cutter **75** including, but not limited to, motor driven rotary or sliding knife cutters, guillotine cutters, rotary die cutters, or laser cutters. Suitable machine controls (not shown) are connected to the cutter **75** in order to activate it at appropriate intervals along the web **80** to provide cut section to the desired size and at the appropriate location. As is well known in an automatic or semi-automatic machine of this type, the machine controls may be programmable by an operator to cut a particular number of sheets of a particular size, or the controls may be automatically interlinked with sensors (not shown) in the machine which sense cutting marks such as printed fiducial marks or punches placed on or in the web, usually along one of the edges, by the printer to signal where cuts should be made. The apparatus **18** may also usefully have any of a number of known sheet collection devices attached such as

collection bins or automatic collators, as for example typically seen at the end of a copying machine. An automatic collator may easily be interconnected with and be responsive to the machine controls (or computer **12**) so as to collect and collate cut sheets. In addition to marks placed by the printer to indicate cutting positions, as discussed above, the printer **14** may also place along one edge marks and/or text relating to the sorting or collating or an order and/or identifying an order with a particular customer. this information may even include an address label where the product is to be delivered.

FIGS. **5***a* and **5***b* illustrate elevational and end views, respectively, of an alternative embodiment of the folding section of the apparatus **18** as previously set out above. In this alternative embodiment, the folding section **68** of FIG. **2***a* is replaced with a V-shaped guide channel **150** having generally V shaped mouth **152**. The guide channel **110** forms a generally V-angle α of substantially 180 degrees which decreases along the channel while progressing from right to left in FIG. **5***a* until it reaches a V-angle α^* of substantially 0 degrees. In operation, a media web **80** (shown in FIG. **5***a* by dashed lines) may be transported through the guide channel **150** by driving rollers **70**. Looking at FIG. **5***a*, the web **80** enters the guide channel **150** at the mouth **152** on the right and as it passes through the channel from right to left, is continuously folded on itself. Flanges **154** at the edges of guide channel **150** serve to constrain the web **80** as it passes through the channel **150**. Once the web **80** is folded, the web **80** is sealed by the action of pressure rollers **70**. In this embodiment, the image-bearing side **81** of the web **80** contacts the inner surface **160** of the guide channel **150**; therefore it is preferable that these surface **160** be smooth, for example polished metal, or be coated with a very smooth slippery material such a Teflon®.

The embodiments of the invention so far disclosed have all described the continuous folding and adhering to itself co-extensively of a simple web bearing at least one image to form a two-sided image bearing entity which is then cut transversely across the web into separate folded image products. It should be understood that the present invention also comprises the folding of an image bearing media web on itself and adhering to itself only at certain areas, for example only along one edge, or in a striped pattern, or in specific patches. The areas of adhesion of the folded web can be controlled by a variety of techniques, for example but not by way of limitation, by placing adhesive only in certain areas prior to folding. Further, the media web can also be pre-cut at certain locations prior to folding so as to produce a variety of two-sided image bearing products.

Pre-cutting of the web or an adhesive sheet such as photographic dry-mount tissue prior to the folding steps can be accomplished by any of a number of methods including, for example but not by way of limitation, die cutting or by a numerically controlled cutting device such as a laser cutter. A particularly useful method and system for introduces cuts in an image bearing web or adhesive sheet is disclosed in U.S. Pat. No. 5,438,896. FIG. **11** depicts the system **180** of the '896 patent where a x, y plotter **182** has pen carrier **184** fitted with knife pen **185**. Plotter **182** is under the control of computer **186** (which alternately may be computer **12**) which has been programmed to send commands for cutting shapes **188** in web **80**. FIG. **11***a* shows a detailed cross-sectional drawing of knife pen **185** where knife blade **187** is mounted on shaft **189**. Shaft **189** is rotatably mounted in pen barrel **190**. In operation, knife blade **185** is mounted so that cutting point **192** is not on axis with center-line **196**, but trails slightly so that when the direction of travel is changed, blade **185** rotates to adjust to the new cutting direction. A system such as that of FIG. **11** can be used to introduce cuts in an image bearing web or in an adhesive sheet as an off-line operation after the web has been printed with images, but prior to introducing the web to the folder/sealer of FIG. **2***a*. Alternatively, a system like that of FIG. **11** can be adapted to place cuts in a web in an in-line operation as part of a system for a continuous manufacturing operation such as that described earlier for FIG. **1**.

The following products described will serve to illustrate examples of such image products employing variations in areas of adhesion and pre-cutting as just described. FIGS. **6***a*–**6***e* depict a two-sided photo "tent card" made in accordance with the method and apparatus of the present invention. FIG. **6***a* shows the media web **80** prior to folding and sealing by the method and apparatus of the present invention. The web **80** has been pre-printed with images (not shown) on its reverse face **198** in areas of the web **80** which will form the outer, visible portion of the tent card once it has been folded. Web **80** also has a continuous stripe area **200** of adhesive applied along the outer edge **202** on the upper face **204** of the web **80**. Crease lines **206**, **208**, **210** and **212** are shown as introduced by an apparatus such as that illustrated in FIG. **4***a*. Folds are then formed sequentially by a series of folding operations such as those disclosed in either FIG. **2***a* and FIG. **3** or FIGS. **4***a*–**4***b*. Referring to FIGS. **6***b* and **6***a*, and using any of the folding methods previously disclosed, a first fold **216** is made along crease line **206** by folding the edge **214** over the upper face of the web **80**, where the upper face is that face showing in FIG. **5***a*. A second fold **218** is made along crease line **208** by folding the previously folded web under toward the reverse face of web **80**. The third fold **220** is made along crease line **210** by folding all the previous folds over the upper face of the web **80**. Finally, the fourth and last fold **222** is made along crease line **212** by folding the edge **202** over the upper face of web **80**. FIG. **6***b* represents an enlarged end view of the web **80** after it has been folded as described along crease lines **206**, **208**, **210** and **212** of web **80** in FIG. **6***a*. Referring again to FIG. **6***b*, the edge **202** of web **80** is next sealed to the flap **230** created by the fold **216** along line **206** by activating adhesive stripe **200**, previously provided on web **80**, using pressure and/or heat as previously disclosed. FIG. **6***c* shows the web **80** after it has been folded and sealed; lines **232** indicate where the continuous web **80** is cut so that the individual tent cards **236** can be produced. FIGS. **6***d* and **6***e* represent end and isometric views respectively of the completed tent cards **236** which have been unfolded along line **208** to form a base **238** and allow the cards **236** to stand upright.

FIGS. **7***a*–**7***c* illustrate an alternative embodiment of a two-sided photo "tent card" **234** also made in accordance with the present invention. FIG. **7***a* shows the media web **80** prior to folding by the method and apparatus of the present invention. The web **80** has been pre-printed with images (not shown) on its reverse face **240** in areas of the web **80** which will form the outer, visible portion of the tent card **234** once it has been folded. A crease line **242** is formed in web **80** by the apparatus shown in FIGS. **2***a*–**2***c*. A pressure activated adhesive has been applied in areas **246** by any of the methods disclosed previously. Three sided tabs **252** are formed in web **80** using, for example, a die cutter or the apparatus disclosed in FIGS. **11** and **11***a,* applied to the web at an earlier stage of manufacture. Using one of the methods previously disclosed, the web **80** is folded in half along crease line **242**, by folding upper edge **248** over the upper face of web **80**, until it meets lower edge **250**, where the upper face of web **80** is that face shown in FIG. **7***a*. FIG. **7***b* shows the folded web; the die cut tabs **252** and adhesive

areas **246** are shown in dotted lines as they are now under the folded over web. Lines **256** indicate where the continuous folded web **80** is cut so that the individual tent cards **234** can be produced. FIG. **7***c* shows an assembled tent card **260**. The tent card **260** is assembled by manually folding the die cut tab **252** inward and manually applying pressure thereby adhering the adhesive area **246** to the inside **262** surface of the card. On the completed tent card **234**, images are visible on outside surface **264**.

FIGS. **8***a*–**8***b* illustrate various stages of manufacture of a two-sided photo bookmark **408** made in accordance with the method and apparatus of the present invention. In FIG. **8***a*, media web **80** is shown prior to the folding and sealing steps needed to make bookmark **408**. Web **80** has been pre-printed with images on its reverse face **312** in the areas indicated by dotted rectangles **314**. Adhesive is provided to the upper face of web **80** in the pattern indicated by the shaded area **316**. Three-sided tabs **318** have been previously cut into the web **80** using, for example, a die cutter applied to the web at an earlier stage of manufacture. The web **80** is folded in half along line **320** using the methods already disclosed by folding edge **322** over the upper face of the web **80** until it is aligned with edge **324** and the folded web is then sealed as previously described. FIG. **8***b* shows the folded and sealed web; die cut tabs **318** are shown in dotted lines **326** as they are now under the folded over web **80**. Cut lines **328** indicate where the web **80** will be cut to create the completed bookmarks **408**. FIG. **8***c* shows a bookmark **408** in a partially unfolded state for the purposes of illustration and to indicate more clearly its construction. FIG. **8***d* is an perspective view of a completed bookmark **408** with the tab **318** pulled up. Tab **318** does not adhere to the back **330** of the bookmark because no adhesive has been applied there. In the embodiments of two-sided image-bearing products described thus far all images are printed digitally on a web prior to the other steps of the addition of an adhesive, making of cuts in the web, and the folding and sealing of the web to itself in various configurations. In another aspect of the present invention, it can be envisioned that at times it will be desirable to have a two sided image product which makes provision for the addition of supplemental material to the product after it has been manufactured. For example, with album pages such as those made by the apparatus of the present invention as illustrated in FIGS. **2***a*–**2***d*, a user of such an album page may wish to add certain items to the page once it has been printed and folded. For example, a user may want to add to an album page an original hard copy photographic print which may not be available in digital form, or a piece of printed memorabilia such as a concert ticket, or a postcard, as is often done in the construction of a multi-media scrapbook. FIG. **9** shows one side of a two-sided photoalbum page **400** made in accordance with the present invention and which incorporates various features allowing the addition of supplemental items. The album page **400** of FIG. **9** has pre-printed images **402**, **404**, **406** and **408**. In addition, cuts **410** have been introduced into the page **400** and positioned to allow an item such as, for example, a hard copy print **424** to be inserted and retained in the page **400** by its corners **412** or postcard **414** to be inserted and retained by its corners **416** in a like manner. The manufacture of the album page **400** depicted in FIG. **9** uses a process as previously described for the products depicted in FIGS. **6**, **7** and **8**. In a manner analogous to that described for these previous products, cuts **410** are made through one layer at a stage of manufacture after the pre-printing of images **402**, **404**, **406** and **408**, but prior to the addition of adhesive and prior to folding to form the two-sided page product. Also as described earlier, cuts **410** may be made by any suitable means including, for example, die cutting, laser cutting or cutting by a numerically controlled machine such as that described in FIG. **11**. Adhesive is applied in all areas of the web **80** prior to folding except those areas defined by dotted boxes **418**, **420** and **422**; this assures that supplemental materials such as the hard copy print **424** and postcard **414** may be easily inserted and later removed if desired with no adhesive contacting corners **412** and **416**. The cuts **410** shown placed at the corners **430** of a pre-printed image **408** illustrate another variation where pre-printed image **408** is used merely to indicate where the original hard copy print **407** from which image **408** was derived is to be inserted into the album page **400**. Pre-printed image **408** can also serve as a reminder of the location of print **407** should it ever be lost from the page **400**. The area defined by dotted box **422** is also left free of adhesive for this latter variation. In yet another variation, area **432** is cut out so that when the page is folded, adhesive **434** is left exposed. Area **432** may then be used to add other supplemental materials into the page such as, for example, concert ticket **436**, which is pressed against pressure-activated adhesive **434** and retained on the page **400**. Finally, once page **400** has been folded and sealed, binder holes **438** are punched and hinge **440** is formed by embossing, using any well-known embossing technique. These latter steps of punching holes **438** and embossing hinge **440** may be performed at the cutting and finishing stage of manufacture as shown, for example, FIG. **2***a*.

FIG. **12** shows the front side **442** and the reverse side **444** of an advertising display **446** made in accordance with the present invention and which incorporates yet another feature allowing the addition of supplemental materials to the product. The display **446** shown in FIG. **12** is designed to hold a supply of image-bearing items, for example image bearing business cards **378**, which may be removed and kept by a customer for later reference. Front side **442** has printed thereon an advertising message **452** and an image of a business card **456** which serves to indicate where business cards **378** are to be inserted; reverse side **444** may also have an advertising message **454** printed thereon. The manufacture of the display **446** depicted in FIG. **12** uses a process as previously described for the products depicted in FIGS. **6**, **7**, **8** and **9**. In a manner analogous to that described for these previous products, a cut **448** is made through front side **442** and cut **450** is made through reverse side **444** at a stage of manufacture after the pre-printing of messages **452** and **454** and image **456**, but prior to the addition of an adhesive and prior to folding to form the two-sided product. Also as described earlier, cuts **448** and **450** may be made by any suitable means including, for example, die cutting, laser cutting or cutting by a numerically controlled machine such as that described in FIG. **11**. Adhesive is applied in all areas of the web prior to folding except in the areas defined by dotted areas **458** and **460**. The absence of adhesive in the area defined by area **458** assures that business cards **378** may be easily inserted via cut **448** and later removed when the completed product **446** is in use. The absence of adhesive in the area defined by box **460** allows flap **462** to be unfolded from the completed display; flap **462** thus unfolded provides a brace so that the display **446** can stand alone.

In order to understand the present invention, a description of the operation of the system **10** will now be discussed. The computer **12** initially obtains orders for an image product such as an album page, tent card, etc. These orders may be obtained over a communication network such as the internet or entered manually by an operator. These orders may be obtained from a large number of different customers each

ordering a customized image product. This information is properly managed by computer **12** and manipulated in accordance with the customer's order. The appropriate information is sent to printer **14** where the appropriate images are printed on a web. In addition the printer **14** prints any appropriate information, marks or other indicia that may be read and used by later components or users of system **10**. Thereafter, the later components receive the web **80** and provide the appropriate processing. Appropriate information and/or instruction are forwarded to these components by computer **10**. For example, the web **18** may be sent to adhesive applicator **17** where an adhesive coating is applied prior to the web being forwarding to apparatus **18** if the adhesive is not applied by apparatus **18**. The adhesive may be selectively applied to designated areas for providing unique image products in accordance with the customer's order. Also the web may be sent to die cutter **16** for providing appropriate cuts in the web that may used in the finished image goods. Hereagain, computer **12** will provide appropriate information and/or instructions which allows for providing of custom image products. Alternatively, the web **80** may be sent directly to device **18** where an adhesive web is applied to the web **80**, the web **80** folded and cut to provide the appropriate finished image goods. As discussed above, a removable label may be provided that is attached to the finished goods. These labels may be used for collating the customer orders and/or for the returning the goods to the customers. It can be seen that the above system may provide multitude different customized image products for numerous different customers each potentially located at different locations.

The invention has been described in detail with particular reference to certain preferred embodiments thereof, but it will be understood that variations and modifications can be effected within the scope of the invention.

Parts List

10 manufacturing system
12 computer
14 digital printer
16 die cutter
17 adhesive applicator
18 folder/cutter/sealer
20 image source
24 print media
30 internet
32 remote location
34 remote location
36 remote location
38 remote location
40 internet service provider
41 frame
42 processing path
44 entrance
46 exit
48 transport roller
50 transport roller
52 transport roller
54 transport roller
56 guide roller pair
58 guide roller pair
55 folding roller pair
60 guide roller pair
62 guide roller pair
64 guide roller pair
65 folding roller pair
66 guide roller pair
68 folding section
70 drive rollers
72 sealing rollers
75 cutter
80 media web
81 image-bearing side
82 non-image-bearing side
84 adhesive area
85 creasing roller
90 adhesive web
91 die
94 application roller
95 folding section
97 crease line
98 web section
99 web section
101 arrow
104 guide flange
105 cut sheets
106 creasing mechanism
108 creasing roller
109 die
110 creasing roller
111 die
113 die
112 creasing roller
115 channel mouth
116 crease line
117 crease line
118 crease line
131 perforations
132 two-sided album page
133 removable segments
134 pre-printed image
150 guide channel
152 channel mouth
154 flange
160 inner surface
180 cutter system
182 plotter
184 pen carrier
185 knife pen
186 computer
187 knife blade
189 shaft
190 pen barrel
192 cutting point
196 center line
198 reverse face
200 adhesive area
202 edge
204 upper face
205 bookmark
206 crease line
208 crease line
210 crease line
212 crease line
214 edge
216 fold
218 fold
220 fold
222 fold
232 cutting line
234 tent card
236 tent card
238 base
240 reverse face

242 crease line
246 adhesive area
248 edge
250 edge
252 tab
256 cutting line
260 assembled tent card
262 inside surface
264 outer surface
312 reverse face
314 rectangular area
316 adhesive area
318 tab
320 crease line
322 edge
324 edge
326 tab cut line
328 cut line
330 bookmark back
378 business cards
400 photoalbum page
402 preprinted image
404 preprinted image
406 preprinted image
407 hard copy print
408 preprinted image
410 cut
412 corner
414 postcard
416 corner
418 defined area
420 defined area
422 defined area
424 hard copy print
430 corner
432 cut area
434 adhesive
436 ticket
438 binder hole
440 hinge
446 image product
442 front side
444 reverse side
446 advertising display
452 advertising message
454 advertising message
456 image
448 cut
450 cut
458 defined area
460 defined area
462 flap

What is claimed is:

1. An apparatus for manufacture of a two-sided image product, comprising:

a transport device for moving a web of media in a direction longitudinal to said web, said web having an image bearing side and a non-image bearing side with a plurality of undetermined images printed on said image bearing side, and said non-image bearing side having an adhesive thereon;

a device for applying adhesive to said non-image bearing side of said web of media:

a creasing device for forming a crease line on said web of media, said crease running in said longitudinal direction along said web; and

a folding device for folding said web of media along said crease so that said non-image bearing side contacts itself so as to adhere said non-image bearing side to itself wherein said folding mechanism comprises a plurality of adjacent rollers that progressively come together so as to fold said web so that said non-image bearing side contacts itself so as to adhere said non-image bearing side to itself.

2. The apparatus of claim **1** further comprising a device for pre-cutting said web of media in certain areas.

3. The apparatus of claim **2** wherein said device for pre-cutting said web of media comprises a die cutter.

4. The apparatus of claim **2** wherein said device for pre-cutting said web of media comprises a laser cutter.

5. The apparatus of claim **2** wherein said device for pre-cutting said web of media comprises a numerically controlled plotter fitted with a knife pen.

6. The apparatus of claim **1** wherein said device for applying adhesive further comprises a coater for coating said adhesive on said web of media.

7. The apparatus of claim **1** wherein said device for applying adhesive further comprises a tacker for tacking an adhesive sheet to said web of media.

8. The apparatus of claim **7** further comprising a device for pre-cutting said adhesive sheet prior to tacking said adhesive sheet to said web of media.

9. A system for making customized two sided image products for a plurality of customers, comprising:

a computer for coordinating a plurality of customer orders for custom image products having image content;

a digital printer for printing said image content of said customer orders on an image bearing side of a web of media, said web having a non-image bearing side;

an adhesive applying mechanism for applying an adhesive on said non-image bearing side of said web;

a folding mechanism for folding said web such that said non-image bearing side contacts itself as the web moves longitudinally along its length, wherein said folding mechanism comprised a plurality of adjacent rollers that progressively come together so as to fold said web; and

a cutting mechanism for cutting said folded web for separating said custom image products from said web.

10. A system according to claim **9** wherein said adhesive mechanism, said folding mechanism and said cutting mechanism are provided in a single apparatus.

11. A system according to claim **9** further comprising a cutting device for providing cuts in said web prior to folding of said web that are to be used in custom product.

12. A system according to claim **9** wherein a creasing mechanism is provided for provided at least one crease about which said web is to be folded.

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